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Accelerated implementation of database systems for a Geosphere Characterisation Programme

Information Management and Environment & Hazards Programmes

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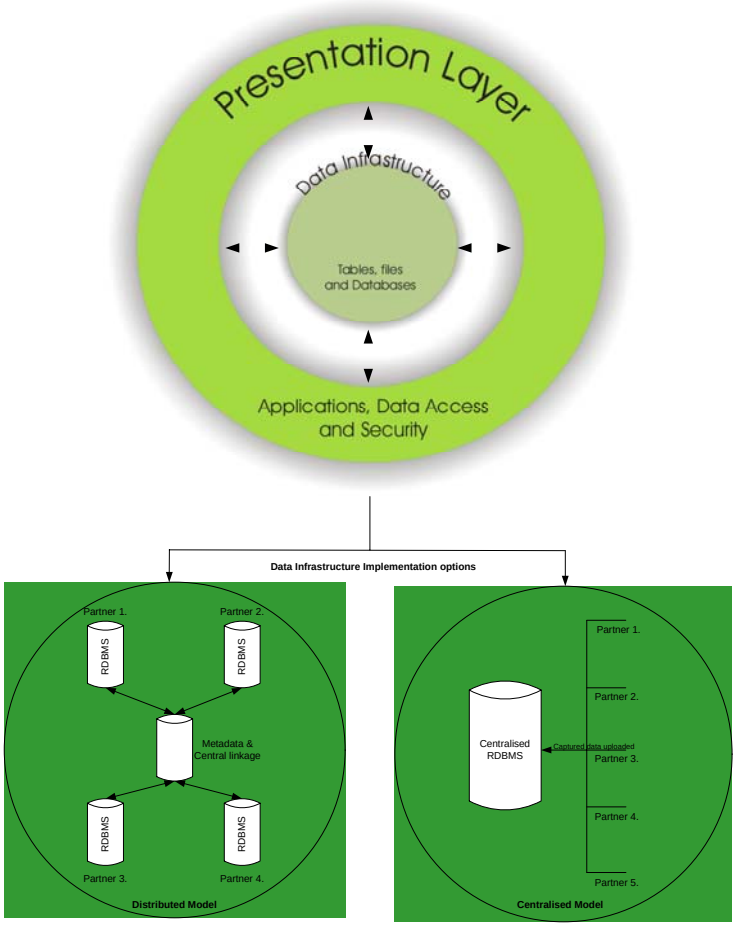

BRITISH GEOLOGICAL SURVEY

INFORMATION MANAGEMENT AND ENVIRONMENT & HAZARDS PROGRAMMES

Accelerated implementation of database systems for a Geosphere Characterisation Programme

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Foreword

This report is the published product of a study by the British Geological Survey (BGS) into the requirements necessary to accelerate the design and implementation of the Nirex Geoscience Database System (elsewhere referred to as the 'NGDS' or 'Data System') for a possible geosphere characterisation programme by UK Nirex Ltd (hereafter referred to as Nirex). Specific issues relating to the previous Nirex Digital Geoscience Database (NDGD) are also addressed within this report.

The information contained within this report should be read in conjunction with BGS Commissioned Report CR/05/042 "A 'Data System' to support a Geosphere Characterisation Programme - An Awareness Document" (Baker, 2005).

Acknowledgements

Many individuals within the BGS 'Information Management' and 'Environment and Hazards' programmes contributed to this investigation and report, providing assistance at all stages of the study. In addition to the collection of data, many individuals have given freely of their advice, and provided specialist knowledge important to the success of the scoping study. Key staff members helped to review draft versions of the chapters of this report. Among many individuals who contributed to the Project we particularly thank Mr J Careless and Dr R P Shaw.

Contents

1 Introduction

Nirex is undertaking a Geosphere Characterisation Project that will demonstrate on the basis of designs and documents that:

- if requested to do so, Nirex could implement a programme of geosphere characterisation;
- it is practicable to characterise a site for the development and implementation of a phased geological disposal facility in the UK.

The Geosphere Characterisation Project will support the Committee on Radioactive Waste Management (CoRWM) in assessing the viability of the Nirex Phased Disposal Concept. Variants to the Geosphere Characterisation Project designs and documents will also be provided. These will indicate how characterisation would vary if, on the basis of a Government decision or the recommendations of CoRWM, it was decided to develop a near-surface or deep interim storage facility for radioactive wastes rather than proceeding directly towards the development of a phased geological disposal facility.

Data management will be a critical part of a Geosphere Characterisation Programme, in order to ensure that data are acquired in formats suitable for efficient processing, storage, and dissemination to all potential users.

A British Geological Survey (BGS) awareness document (Baker, 2005) was designed to inform Nirex Programme and Project managers about a proposed method for design and implementation of an integrated database system to provide a central store for data holdings generated by a possible future Geosphere Characterisation Programme.

Preliminary Nirex programming studies assumed that sites for detailed characterisation would be selected following a systematic geographical search process, including extended periods of consultation with key stakeholders. It was assumed that three and a half years would be required from commencement of the geographical search to the announcement, by Government, of the sites that would be investigated. It was further assumed that, following announcement of the sites for investigation, a year would be required to obtain planning permissions to undertake the investigations. Thus, four and a half years would elapse from commencement of the site selection process to commencement of investigations at the selected site(s).

The studies also assume that approximately two and a half years would be required for implementation of the data management systems within the Programme. This includes time for:

- Developing ideas about how to make information available to key stakeholders;
- Developing the specifications for the Data System;
- Procuring contracts for the design and implementation of the Data System; and
- Building and testing the Data System.

Such a period could readily be accommodated within the overall duration of the Programme and the activities would be undertaken in parallel with the site selection process.

During subsequent discussions with the Nirex Directorate concerning possible programmes for implementing geosphere characterisation raised the question of possible implications if the time

budgeted for the site selection process was reduced significantly. Such a situation could arise, for example, if a local community volunteered to host a repository.

If site selection extent was reduced significantly and the planned Data System implementation programme retained, then the Data System might not be ready for the start of the investigations if the implementation commenced alongside the site selection process. Thus, either the start of the investigations would need to be delayed pending availability of the Data System or the investigations would need to commence before the Data System was available.

The latter scenario was experienced during the Sellafield investigations, when the Nirex Digital Geoscience Database (NDGD) did not become functional until some five to six years after the start of the investigations. This created significant problems, most notably that information could not be made available to key stakeholders in a timely manner. Such failure to be forthcoming with information derived from the investigations is alien to the culture of openness and transparency that is now the accepted norm.

Nirex has a clear preference for ensuring that the proposed Data System is functional (designed, built and tested) prior to commencement of data acquisition at any of the sites to be investigated.

A number of possible approaches could be taken to ensure that the Data System is in place prior to commencement of the investigations and to remove their development from the critical path of the Programme. Possible approaches include:

- Commence development of the Data System prior to instigation of the site selection process; or
- Use the existing NDGD structure as the core of the Data System, adding whatever enhanced functionality is possible within the time available.

Two alternative scenarios must be considered. Firstly, that it is decided to recommence investigations at the Longlands Farm Site near Sellafield and, secondly, that a decision is taken to study a new site, or new sites, not previously investigated.

It is stressed that the above are hypothetical scenarios. The potential use of Sellafield data to populate any new database is for test purposes only. Their use does not indicate any intent on the part of Nirex to suggest that Sellafield, or any other site, should be selected for future characterisation. The decision on which sites to investigate will rest with Government.

2 High-Level Project Plan

A High-Level Project Plan is required to help understand how the Project to develop the Nirex Geoscience Database System (NGDS; elsewhere referred to as the 'Data System') could be accelerated. This shows the headlines of the Project, such that its overall structure and timescale can be estimated. The Project breakdown is shown in the Gantt chart in Appendix 1. The following major items in the High-Level Project Plan are described below:

- Project Board
- System Overview
- Detailed Project Planning
- Development of Thesaurus and Dictionaries
- Procurement
- Business Process
- Process Modelling
- Object and Component Model
- Data Policy
- Metadata
- Data Management Planning
- Application Development
- Testing

The High-Level Project Plan assumes that the approach to centralised system design will be similar to that of the NGDG in the early- to mid-1990s. In this system all data were stored in a single central Oracle® database, and access was via a wide area network or the Internet. Alternative operational models are now available and should be considered.

2.1 Project Board

2.1.1 Description

The Project Board will maintain overall control of the Project. It should include the following members:

- The Nirex manager who holds the Project budget;
- The BGS Project Manager;
- One or more NGDS users, either from within Nirex or independent of both Nirex and BGS, who will make regular use of the Data System.

The Project Board will own the Project Plan and review progress against the plan. They will set Project tolerances for the Project Manager and review and authorise exception reports, prepared by the Project Manager, when it is anticipated that the Project will exceed one of its defined tolerances.

2.1.2 Responsibilities

Nirex will be responsible for conveninge the Project Board.

2.2 Key Preparation Tasks – System Overview

2.2.1 Description

At the formal start of the Project it is essential that the vision for the Data System is documented formally and agreed. In effect this is the Project initiation document, and will build upon existing source material (e.g. Baker, 2005) to describe the Data System that will be built. It will also describe the methods that will be used to develop the Data System and the hardware and software required for its operation.

Once agreed, the document will enable detailed Project planning to commence, and it will enable procurement procedures for the purchase of hardware and software to be started.

The System Overview equates to the Umbrella Scoping Study / Detailed Awareness Report identified in Section 10 (Roadmap for future development and decisions) of Baker (2005). The short term, Systems Overview, is used as the Gantt chart task name.

2.2.2 Responsibilities

BGS will be responsible for drafting the document, including recommendations for the hardware platform and appropriate software. Nirex will coordinate review of the document and BGS will amend the document in the light of the review.

2.3 Key Preparation Tasks – Detailed Project Planning

2.3.1 Description

Once the System Overview has been agreed, detailed project planning can take place. This will expand the outline Project Plan, developed prior to the start of the Project, into a report. The report which will describe each task in detail and enumerate the inputs to, and products of, each task. It will also identify key skills required for each task and propose named individuals to lead the tasks. Overall staff effort required for each task will also be identified.

Once completed and approved the detailed Project Plan will be owned by the Project Board, who will undertake periodic revisions during the life of the Project.

The Detailed Project Planning task equates to the Costed Project Proposal Report discussed in Section 10 (Roadmap for future development and decisions) of Baker (2005).

2.3.2 Responsibilities

BGS and Nirex should develop this document jointly, ensuring that the Plan meets Nirex expectations fully within the Project's budgetary constraints.

2.4 Key Preparation Tasks – Development of Thesaurus and Dictionaries

2.4.1 Description

A key activity is to define the scientific language that will be used throughout the Project and hence within system databases. There are two elements to this work. The first is to construct a definitive Project thesaurus that contains all scientific terms that will be used during the Project, and will provide a definition of each term and a reference to the source of any standards. For example, the term "Fine-sand" is defined as a "a siliciclastic sedimentary particle in the size

range >=125 – <250 μm" using the "Udden-Wentworth grain-size scale for siliciclastic sediment (Wentworth, 1922)". The second element is to derive individual dictionaries from the thesaurus, for use in validating the data entered into the databases and for use within applications (e.g. to produce drop-down lists of values). These will be used to develop all data collection guides, such as logging manuals for boreholes. This development must be done early in the Project so that all parties understand each technical term in the same way. This will reduce the potential risk of hostile council exploiting ambiguity of meaning across the Project at any future public enquiry. The thesaurus and dictionaries should be managed throughout the Project by a scientific language steering committee.

2.4.2 Responsibilities

BGS will develop the Thesaurus using its existing expertise, pre-existing standards, internationally accepted thesauri and best practice. In cases where additional advice is required to develop a Thesaurus segment, BGS will recommend appropriate experts to Nirex. Once the Thesaurus is complete BGS will recommend the names of potential reviewers to Nirex. BGS will also publish the Thesaurus on an Internet site accessible from both Nirex and BGS, where it can be reviewed and commented upon by any interested party. Following its review BGS will revise the Thesaurus and then develop the necessary dictionaries.

2.5 Procurement

2.5.1 Description

A crucial element of the Data System development will be the procurement of hardware, software and any infrastructure required. Setting up the proposed NGDS may involve external hosting and licensing agreements or the actual purchase of hardware, software and infrastructure equipment (to be defined in later reports). Considering the size and complexity of the data holdings to be acquired for this Geosphere Characterisation Programme, if approval to proceed is given the hosting or procurement activities will be carried out under the OJEC policy and procedures.

The Procurement equates to the Hardware and Software Purchase identified in Section 10 (Roadmap for future development and decisions) of Baker (2005). The short term, Procurement, is used as the Gantt chart task name.

2.5.2 Responsibilities

After selection of a suitable option from a later 'Costed Implementation Proposal' BGS will advise Nirex on the better option regarding procurement, whether the purchase of hardware, software and any infrastructure equipment or the hosting and licensing pathway. BGS will document the technical requirements for the equipment and resources required by the chosen NGDS option.

Nirex will arrange procurement, maintenance and support for the selected option.

2.6 System Design and Implementation – Business Process

2.6.1 Description

In order to represent the required functionality for the NGDS fully it is necessary to identify and capture details of the relevant business processes. In this context the term Business Process

entails the execution of a sequence of one or more process steps having a clearly defined deliverable or outcome. These processes will represent key business functions within the Data System and reveal relationships and dependencies within (and outwith) the proposed Data System.

At this stage it is necessary to identify the processes at a high level and capture the following information:

- External requirements and drivers
- Business functions
- Goals, objectives and performance measures
- Data classes
- Stakeholders
- Physical locations
- Timeliness

The identification of these functions and processes will reside within the scope definition and planning stages of the development lifecycle.

The System Design and Implementation – Business Process equates to a component of 'Data System' Development Phase 1 identified in Section 10 (Roadmap for future development and decisions) of Baker (2005). The short term, Business Process, is used as the Gantt chart task name.

2.6.2 Responsibilities

Responsibilities for successful execution of this task lie within two areas, namely requirements expression, by Nirex, and detailed analysis by BGS. It will be Nirex's responsibility to provide sufficient information, either through formal documentation or structured interviews, to allow the identification and capture of all relevant Business Processes. The outcomes of this task will feed directly into the detailed process-modelling task and contribute to a detailed Business Process map. A requirement of this task will be achievement of full acceptance of the identified processes by Nirex prior to continuation into the next task.

2.7 System Design and Implementation – Process Modelling

2.7.1 Description

Once the high-level Business Processes have been documented they will require detailed analysis to determine the full process models and eliminate overlaps and ambiguity between functions. At this stage detailed formal process diagrams and models will be generated to express the key functions required within the Data System and will take the form of conceptual models. The information that will be captured for these processes and defined at this stage includes:

- Policies, procedures and standards for each process
- Specific business data
- Roles and responsibilities
- Physical locations
- Events for each process including detailed sequencing.

Following determination of the conceptual models a further sub-task will be to define the logical models containing the following key information:

- Business rules affecting the processes
- Logical data models and data relationships underpinning the system information
- Representation of access privileges defined by roles and responsibilities
- Logical system architecture and physical locations
- Events and responses triggered or constrained by business processes / events.

The System Design and Implementation – Process Modelling equates to a component of 'Data System' Development Phase 1 identified in Section 10 (Roadmap for future development and decisions) of Baker (2005). The short term, Process Modelling, is used as the Gantt chart task name.

2.7.2 Responsibilities

Following on from the requirements for the Business Process capture task, further analysis and development of these outline functions will be required by BGS. Nirex will be required to provide input and additional information into this task in the form of documentation, consultation and review. BGS will provide relevant documents and software models to communicate the full structure of the NGDS business processes. This documentation will provide direct input into the Object and Component Modelling task.

2.8 System Design and Implementation – Object and Component Model

2.8.1 Description

To specify and control the development of software it is prudent to represent the software system fully within the context of the Business Processes identified in previous tasks. This task will take the approved Business Process map in conjunction with the logical model information to identify and specify key system attributes in the form of objects and components. Following definition of the component structures a rationalisation phase will be necessary to ensure that components are reused across the Data System and that replication is eliminated as far as is practical. Key deliverables of this task are class diagrams, object diagrams and sequence diagrams.

The System Design and Implementation – Object Component Model equates to a component of 'Data System' Development Phase 1 identified in Section 10 (Roadmap for future development and decisions) of Baker (2005). The short term, Object Component Model, is used as the Gantt chart task name.

2.8.2 Responsibilities

It will be the responsibility of BGS to translate the approved Business Process map, logical models and other key information into fully specified Object and Component representations. Following the development of the relevant documentation Nirex will be required to review and approve functional area Component diagrams before any development of software code commences during the Application Development tasks.

2.9 Data Policy

2.9.1 Description

A Project Data Policy describes how data will be collected, managed and disseminated, and what will happen to the data when the Project is concluded. The purpose of such a Policy is to ensure that all data are managed in a consistent manner. This is important for data that are likely to be subject to public enquiry.

The Policy will highlight the need for a separate Metadata Policy and the need for data management planning for the whole Project and for individual datasets.

2.9.2 Responsibilities

BGS will produce a draft Data Policy for Nirex to review. Once reviewed, revised and agreed it will be implemented across the Project.

2.10 Metadata

2.10.1 Description

Information associated with data that set the data in context is known as metadata. Without various forms of metadata the original data are often poorly understood or unusable. As demonstrated by the Cabinet Office mandate for all Government datasets to have metadata compliant with the eGovernment Metadata Standard, provision of metadata is now recognised as critical.

A Project Metadata Policy will need to be compiled, defining the levels of metadata to be collected, the metadata standard to be used and how the metadata will be managed and disseminated.

2.10.2 Responsibilities

BGS will prepare a Metadata Policy that will be reviewed by Nirex. After review and revision the Policy will be followed when BGS compiles and publishes the NGDS. BGS will maintain the metadata during the life of the database.

2.11 Data Management Planning

2.11.1 Description

The Data Policy will recommend the need for a Data Management Plan (DMP) for the whole Project, and for separate DMPs for the individual datasets that the Project will collect. These plans will contain the details of how individual datasets should be managed, taking into account any special requirements related to the data types involved.

2.11.2 Responsibilities

BGS will produce a document proposing how data management planning should be carried out within the Project. Once this has been reviewed, revised and approved BGS, in conjunction with Nirex and its stakeholders, will produce DMPs for the Project and for the individual datasets collected by the Project.

2.12 Applications Development

2.12.1 Description

The NGDS will require a range of applications so that users can load, access and manipulate the data within the database. The applications required will vary during the life of the database but it is proposed that an initial applications suite be developed. These will be:

- Data Loading Applications
- Data Viewing Applications
- GIS Applications

The data loading applications will enable existing datasets held in a variety of systems to be loaded into the NGDS. The data viewing application will be a web-based tool that will allow a wide range of users to browse the database. It will be similar in design to the Padamot database (http://www.bgs.ac.uk/padamot/home.html), which can be accesses via any Internet browser, providing the user has authorisation. The GIS application will be a web-based mapping system that will allow the database to be queried spatially.

The Applications Development equates to 'Data System' Development Phase 2 identified in Section 10 (Roadmap for future development and decisions) of Baker (2005). The short term, Applications Development, is used as the Gantt chart task name.

2.12.2 Responsibilities

BGS will be responsible for developing the application development proposal. This document will describe in detail the initial applications to be built, and document their proposed functionality. It will be based on the outputs of the Business Process modelling activity, which will capture the primary requirements for data usage. Nirex will arrange for review of the draft and BGS will revise the document in the light of the comments. Once the requirement is agreed, the three primary application areas will be developed and the applications will be trialled under the testing activity.

2.13 Testing

2.13.1 Description

Testing of the NGDS while it is under development and at the end of the development schedule is vitally important to ensure that the Data System can fulfil all the agreed requirements from the Detailed Project Plan. To document testing a Test Plan will be created outlining the various stages of testing and, crucially, 'Whole System Testing', which will be carried out, reviewed and approved by Nirex or a nominated representative.

Testing equates to System Testing / Acceptance Testing identified in Section 10 (Roadmap for future development and decisions) of Baker (2005). The short term, Testing, is used as the Gantt chart task name.

2.13.2 Responsibilities

BGS will outline the 'Test Plan' to be approved by Nirex. Testing will be carried out by BGS and externally by a contractor to be appointed by Nirex, pending ultimate approval by a Nirex 'Geosphere Characterisation' Programme Manager.

3 Methods and issues concerning accelerating the implementation of a 'Data System'

A previous report by Baker (2005) outlined a series of stages for the development and implementation of the Data System. All the stages are required to achieve a robust system to support Nirex's data requirements for the proposed Geosphere Characterisation Programme. The Gantt chart in Appendix 1 shows the critical path analysis and identifies the main activities that consume most of the Project's duration. To accelerate the implementation of the Data System the critical path must be shortened. There are a number of options including:

- Distributed Architecture
- Early Start
- Project Management
- Modularisation
- Appropriate Expertise
- Reduce Review Time
- System Development Methodologies
- Server Farm

3.1 Distributed Architecture

The High-Level Project Plan presented as a Gantt chart in Appendix 1 makes the assumption of a single, centralised database, managed by BGS, that is accessed via a wide area network or the Internet. This approach is the best way of meeting the business processes of Nirex and managing all the data securely. The disadvantage is the 495-day duration of the Systems Design and Implementation, all of which are on the critical path.

An alternative model is that of a distributed architecture. In this model there are many databases that would be operated by each of Nirex's specialist contractors. These would meet the local business needs of the contractor and, in turn, of Nirex. The whole database or an appropriate subset would be made available to BGS, to build into a Data Warehouse. This would be refreshed periodically, depending upon the rate of change of the individual distributed databases and on Nirex's requirement. Refresh periods could be hours, days or weeks as appropriate. BGS would manage the Data Warehouse, which would be the sole source of data for analysis, modelling and reporting.

This model has advantages and risks.

The primary advantage is that the long System Development and Implementation phase is both reduced and removed from the critical path.

The primary risks are increased systems complexity and a larger management overhead. The distributed model requires that all databases be developed and maintained to a clear set of Project standards that must be agreed in advance. The distributed databases must still be managed and coordinated at Project level to ensure that local deviation from Project standards does not impact upon the Project as a whole.

Such an approach would require establishment of a Project Information Architecture Steering Committee to ensure that all distributed database users understood and complied with Project standards.

3.2 Early Start

The High-Level Project Plan identifies three key preparation tasks:

- System Overview
- Project Planning
- Thesaurus and Dictionaries

As described above the Systems Overview (Section 2.2) documents the Data System that is going to be built and makes key decisions. This will act as the Project mandate and allow detailed Project planning (see Section 2.3) to take place. The third key preparation task is building the Thesaurus and Dictionaries (see Section 2.4), which are the basis of the Project-wide scientific language.

All three activities need to be carried out as early as possible, and key elements of them are on the Project critical path.

3.3 Project Management

Project management is recognised as essential by most bodies, yet it is perceived as expensive, as it uses senior and experienced people. As a result it is frequently pared down to reduce Project costs, especially in a competitive tendering environment. However, experience in BGS and elsewhere suggests that emplacement of an appropriately senior and experienced Project Manager who has access to a Project support team will improve quality, reduce total costs and reduce Project duration. Nirex-produced pre-contract documents should stress the importance placed upon Project Management.

3.4 Modularisation

Good Project Management allows projects to be broken down into tasks and work packages. In such a Project Management environment it is possible to modularise the work packages so that they can be sub-contracted to third parties for development. This is especially true of Application Development activities, where individual components can be specified in terms of data inputs and outputs under an overarching Project standards framework. This effectively increases the pool of developers available and provides opportunities for reducing the duration of critical path tasks.

3.5 Appropriate Expertise

This method of accelerating the Project has two aspects:

- Timely advice
- Hybrid developers

It is essential that NGDS development team members have access to timely advice on scientific data issues. If they have to wait a week or more for advice from key individuals on aspects of the Project there will be Project slippage and inefficiency. This problem was encountered in the development of the NDGD in the early- to mid-1990s. Key staff had contract deadlines to meet for Nirex, so supporting other Nirex contactors was of secondary importance to them. It is essential that there is a network of named advisors, each with contracted response times to questions raised by the development team so that questions are answered quickly.

Development teams should include a number of developers who have skills and training both in IT and geoscience. These team members should be supported by pure IT developers. This will

help to ensure that a full contextual understanding of geoscience datasets is grasped during the analysis and development phases.

3.6 Reduce Review Time

The High-Level Project Plan has numerous periods of review by Nirex and stakeholders. Whereas it is recognised that it is essential to have 'customer' review, the periods of time allowed for review need careful management. The High-Level Project Plan includes substantial periods for review and approval. A total of 170 days of Nirex and stakeholder review and approval are on the critical path of the Project. Careful management of review periods on the critical path would reduce Project duration.

3.7 System Development Methodologies

There are a number of system development methodologies available. These claim to offer more rapid development than 'conventional' approaches to systems development. Terms such as 'agile development' and 'extreme programming' are amongst the newer buzz-words in the IT industry. These and other methodologies may offer advantages to the Project. However, there is a need for careful evaluation to ensure that there are real benefits to be gained in terms of time reduction and quality improvement for the additional cost of training staff and licensing software.

3.8 Server Farm

Although procurement is not on the critical path the time for procurement could be reduced significantly by 'renting' space in a commercial server farm. BGS has successfully adopted this approach for the DEAL database (www.ukdeal.co.uk), which is an Oracle® spatial database. Various business models are available, many of which avoid placing competitive tenders large enough to need to meet OJEC requirements.

4 Can the 'NDGD' be used in any way as a platform from which to build a new 'Data System'?

The Nirex Digital Geoscience Database (NDGD) was developed during the early- to mid-1990s. It was designed to facilitate efficient storage and access to the large quantities of data arising from the Site Characterisation Programme. Subsequently it metamorphosed into a database to hold all the data that were presented at public enquiry in 1995 and 1996. The development of the NDGD was conceived and implemented after a significant portion of the geoscience data had been collected by Nirex and its contractors in an assortment of databases, spreadsheets and flat files. The NDGD was the best attempt at the creation of an integrated geoscience database utilising the pre-existing data structure of Nirex's contractors.

The Oracle® core of the NDGD contained only limited spatial data. The bulk of the spatial information was held in a separate GIS, which was linked to Oracle® in an *ad hoc* manner. In the early- to mid-1990s Oracle® did not support spatial data; no relational database did at the time. The database structure is 'littered' with such *ad hoc* links to the GIS.

Finally, in the early- to mid-1990s, Oracle® could not hold time-series data effectively. All Nirex time-series data were held in a separate system outside the NDGD.

In summary the principle problems with the NGDC are:

- The design is a decade out of date;
- The NDGD architecture was unsatisfactory because it was determined by the amalgamation of independently designed contract data structures;
- The NDGD did not handle spatial data;
- The NDGD is littered with *ad hoc* links to the separate GIS;
- The NDGD did not handle time-series data.

The NDGD should not be resurrected and used for the new Project because all its flaws would be inherited by the new System. However, the NDGD does represent a valuable resource for the new Project for the following reasons:

- It provides a list of attributes and their definitions that will speed up design and development
- It is a starting point for the Thesaurus and Dictionaries activity
- It can be used as a test-bed to ensure that data from previous investigations could be accommodated within the implemented NGDS.

5 Principal Recommendations

- The NDGD should not be resurrected as a starting point for the Nirex Geoscience Database System (NGDS) because of the problems inherent within its design.
- The NDGD should be used to inform the design of the new NGDS.
- Nirex should consider a Distributed Architecture as opposed to a Centralised Architecture for the NGDS as a means of reducing duration of development.
- Nirex should consider funding an early start on the key preparation tasks identified in the Gantt chart and in sections 2.2, 2.3 and 2.4 above.
- Nirex should recognise the importance of Project Management for the Project and ensure that pre-contract documents stress that comprehensive Project Management is a key criterion.
- Nirex should recognise the importance of timely advice to the development team and ensure that contracts are let to named advisers with stipulated response times.
- Nirex should consider reducing review time on tasks on the critical path of the Project.
- Nirex should commission a review of rapid system development methodologies to see whether they would contribute to a reduction of the development time.

References

The following are sources of reference used in the creation of the proposed information system model outlined in this report.

Baker, G. 2005. A 'Data System' to support a Geosphere Characterisation Programme - An Awareness Document. British Geological Survey Commissioned Report, CR/05/042.

WEB SITES:

DFID/KaR – R7199 Strategies for Maximising Geoscience Data Value. Link: http://www.bgs.ac.uk/dfid-kar-geoscience/r7199/home.html

PADAMOT - 'Palaeohydrogeological Data Analysis and Model Testing', database design and web site. Link: http://www.bgs.ac.uk/padamot/home.html

PRINCE2 - Official PRINCE2 website. Link: http://www.ogc.gov.uk/prince2/

Rapid Development - Rapid Development Methodologies, Guiseppe Zagarrio, Norwegian University of Science and Technology . Link: http://www.idi.ntnu.no/emner/dt8100/Essay2005/zagarrio.pdf

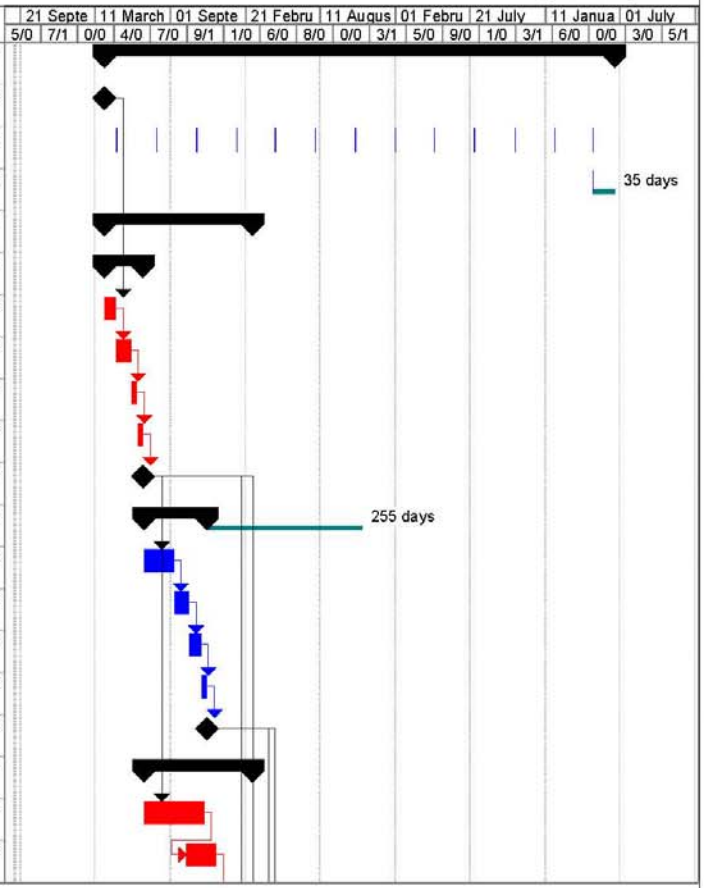
Rapid Development – OpenSourceArmenia, OSA - Development Methodologies. Link: http://opensourcearmenia.com/methodologies_html

Rapid Development – N.Cycles Software Solutions – 'Development Methodologies Compared' Dan Marks. Link: http://www.ncycles.com/e_whi_Methodologies.htm

Appendix 1- Gantt Chart for the High-Level Project Plan

Nirex Geoscience Database System — High Level Project Plan

ID	Task Name	Duration	Start	Finish
1	**Nirex Geoscience Database System (NGDS)**	**840 days**	**Mon 03/04/06**	**Fri 19/06/09**
2	Commence Project	0 days	Mon 03/04/06	Mon 03/04/06
3	**Project Board**	**785 days**	**Mon 01/05/06**	**Fri 01/05/09**
16	Project Board 13	1 day	Fri 01/05/09	Fri 01/05/09
17	**Key Prepartion Tasks**	**245 days**	**Mon 03/04/06**	**Fri 09/03/07**
18	**System Overview**	**65 days**	**Mon 03/04/06**	**Fri 30/06/06**
19	Document System Overview	20 days	Mon 03/04/06	Fri 28/04/06
20	Review (Nirex and Stakeholders)	25 days	Mon 01/05/06	Fri 02/06/06
21	Revise System Overview Following Review	10 days	Mon 05/06/06	Fri 16/06/06
22	Approve (Nirex)	10 days	Mon 19/06/06	Fri 30/06/06
23	System Overview Agreed	0 days	Fri 30/06/06	Fri 30/06/06
24	**Project Planning**	**105 days**	**Mon 03/07/06**	**Fri 24/11/06**
25	Detailed Project Planning	50 days	Mon 03/07/06	Fri 08/09/06
26	Review (Nirex and Stakeholders)	25 days	Mon 11/09/06	Fri 13/10/06
27	Revise Project Plan Following Review	20 days	Mon 16/10/06	Fri 10/11/06
28	Approve (Nirex)	10 days	Mon 13/11/06	Fri 24/11/06
29	Project Plan Agreed	0 days	Fri 24/11/06	Fri 24/11/06
30	**Thesaurus and Dictionaries**	**180 days**	**Mon 03/07/06**	**Fri 09/03/07**
31	Develop Geoscience Thesuarus	100 days	Mon 03/07/06	Fri 17/11/06
32	Review (Nirex and Stakeholders)	50 days	Mon 09/10/06	Fri 15/12/06



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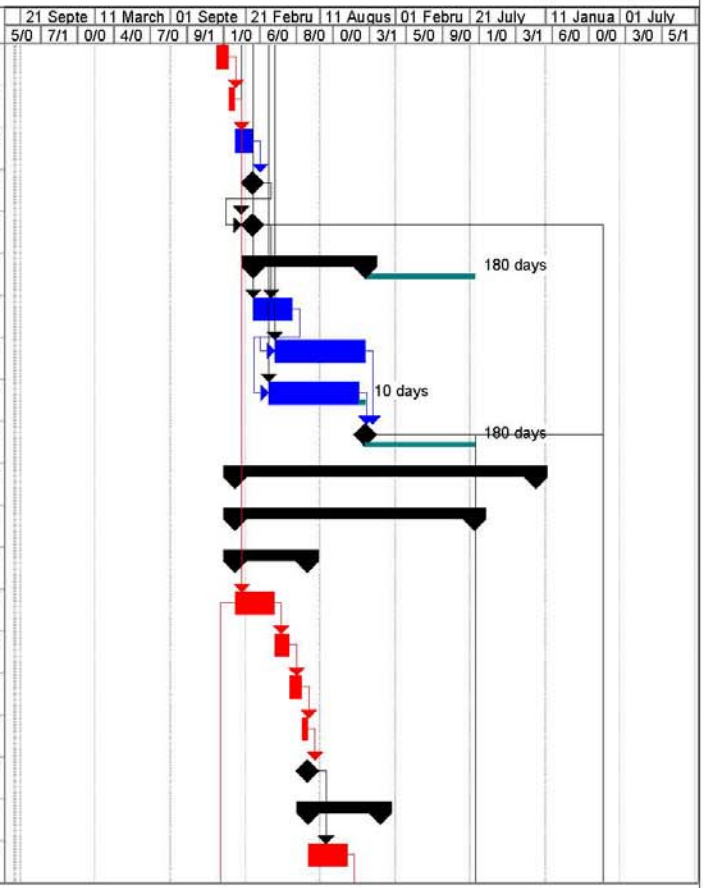
Nirex Geoscience Database System — High Level Project Plan

ID	Task Name	Duration	Start	Finish
33	Revise Thesaurus Following Review	20 days	Mon 18/12/06	Fri 12/01/07
34	Approve (Nirex)	10 days	Mon 15/01/07	Fri 26/01/07
35	Develop and Implement Dictionaries	30 days	Mon 29/01/07	Fri 09/03/07
36	Thesaurus and Dictionaries Developed	0 days	Fri 09/03/07	Fri 09/03/07
37	Key Preperation Completed	0 days	Fri 09/03/07	Fri 09/03/07
38	**Procurement**	**185 days**	**Mon 12/03/07**	**Fri 23/11/07**
39	Pre-procurement Specification	65 days	Mon 12/03/07	Fri 08/06/07
40	Hardware Procurement	150 days	Mon 30/04/07	Fri 23/11/07
41	Software Procurement	150 days	Mon 16/04/07	Fri 09/11/07
42	Procurement Completed	0 days	Fri 23/11/07	Fri 23/11/07
43	**System Design and Implementaion**	**495 days**	**Mon 29/01/07**	**Fri 19/12/08**
44	**System Design**	**395 days**	**Mon 29/01/07**	**Fri 01/08/08**
45	**Business Process**	**120 days**	**Mon 29/01/07**	**Fri 13/07/07**
46	Capture business process relevant to NGDS	65 days	Mon 29/01/07	Fri 27/04/07
47	Review (Nirex and Stakeholders)	25 days	Mon 30/04/07	Fri 01/06/07
48	Revise Business Process Following Review	20 days	Mon 04/06/07	Fri 29/06/07
49	Approve (Nirex)	10 days	Mon 02/07/07	Fri 13/07/07
50	Business Process Agreed	0 days	Fri 13/07/07	Fri 13/07/07
51	**Process Modelling**	**120 days**	**Mon 16/07/07**	**Fri 28/12/07**
52	Detailed Process Modelling	65 days	Mon 16/07/07	Fri 12/10/07



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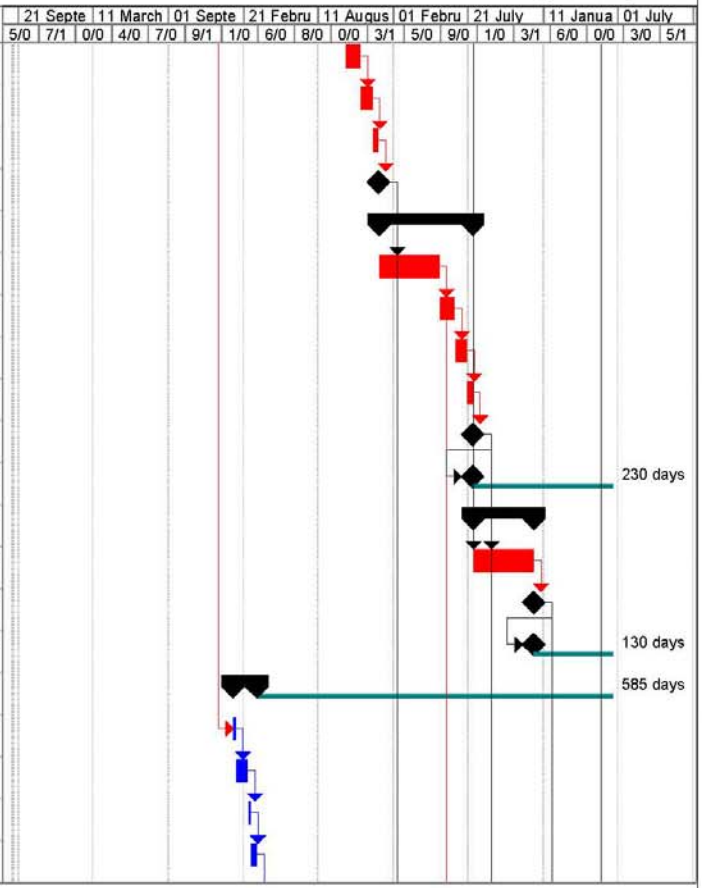
Nirex Geoscience Database System — High Level Project Plan

ID	Task Name	Duration	Start	Finish
53	Review (Nirex and Stakeholders)	25 days	Mon 15/10/07	Fri 16/11/07
54	Revise Process Model Following Review	20 days	Mon 19/11/07	Fri 14/12/07
55	Approve (Nirex)	10 days	Mon 17/12/07	Fri 28/12/07
56	Process Model Agreed	0 days	Fri 28/12/07	Fri 28/12/07
57	**Object and Component Model**	**155 days**	**Mon 31/12/07**	**Fri 01/08/08**
58	Object and Component Modelling	100 days	Mon 31/12/07	Fri 16/05/08
59	Review (Nirex and Stakeholders)	25 days	Mon 19/05/08	Fri 20/06/08
60	Revise Object and Component Modell Following Review	20 days	Mon 23/06/08	Fri 18/07/08
61	Approve (Nirex)	10 days	Mon 21/07/08	Fri 01/08/08
62	Object and Component Model Agreed	0 days	Fri 01/08/08	Fri 01/08/08
63	System Designed	0 days	Fri 01/08/08	Fri 01/08/08
64	**Implementation**	**100 days**	**Mon 04/08/08**	**Fri 19/12/08**
65	Physical Implementation (inc Unit Testing)	100 days	Mon 04/08/08	Fri 19/12/08
66	Implementation Complete	0 days	Fri 19/12/08	Fri 19/12/08
67	System Designed and Implemented	0 days	Fri 19/12/08	Fri 19/12/08
68	**Data Policy**	**40 days**	**Mon 29/01/07**	**Fri 23/03/07**
69	Develop a NGDS Data Policy Document	5 days	Mon 29/01/07	Fri 02/02/07
70	Review (Nirex and Syakeholders)	20 days	Mon 05/02/07	Fri 02/03/07
71	Revise Data Policy Following Review	5 days	Mon 05/03/07	Fri 09/03/07
72	Approve (Nirex)	10 days	Mon 12/03/07	Fri 23/03/07



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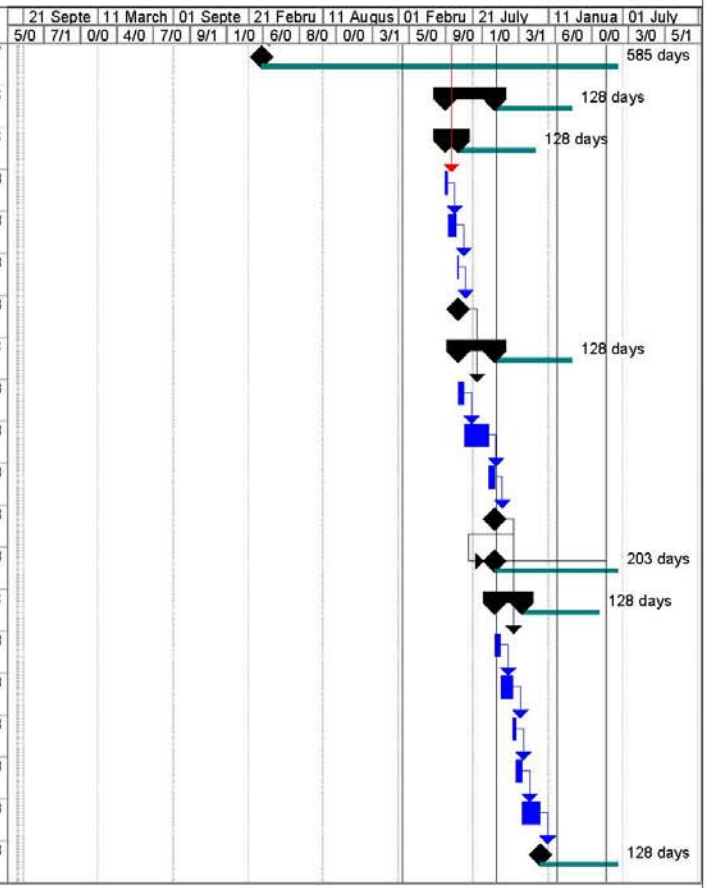
Nirex Geoscience Database System — High Level Project Plan

ID	Task Name	Duration	Start	Finish
73	Data Policy Completed	0 days	Fri 23/03/07	Fri 23/03/07
74	**Metadata**	**82 days**	**Mon 19/05/08**	**Tue 09/09/08**
75	**Metadata Policy**	**22 days**	**Mon 19/05/08**	**Tue 17/06/08**
76	Develop Metadata Policy	5 days	Mon 19/05/08	Fri 23/05/08
77	Review (Nirex and Stakeholders)	15 days	Mon 26/05/08	Fri 13/06/08
78	Revise Metadata Policy Following Review	2 days	Mon 16/06/08	Tue 17/06/08
79	Approve (Nirex)	0 days	Tue 17/06/08	Tue 17/06/08
80	**Metadata Compilation**	**60 days**	**Wed 18/06/08**	**Tue 09/09/08**
81	Identify Key NGDS Datasets	10 days	Wed 18/06/08	Tue 01/07/08
82	Compile Metadata	40 days	Wed 02/07/08	Tue 26/08/08
83	Publish Metadata	10 days	Wed 27/08/08	Tue 09/09/08
84	Metadata Compiled	0 days	Tue 09/09/08	Tue 09/09/08
85	Metadata Completed	0 days	Tue 09/09/08	Tue 09/09/08
86	**Data Management Planning**	**45 days**	**Wed 10/09/08**	**Tue 11/11/08**
87	Develop Data Management Planning Document	10 days	Wed 10/09/08	Tue 23/09/08
88	Review (Nirex and Stakeholders)	20 days	Wed 24/09/08	Tue 21/10/08
89	Review Data Management Planning Document	5 days	Wed 22/10/08	Tue 28/10/08
90	Approve (Nirex)	10 days	Wed 29/10/08	Tue 11/11/08
91	Write Data Management Plans	30 days	Wed 12/11/08	Tue 23/12/08
92	Data Management Planning Complete	0 days	Tue 23/12/08	Tue 23/12/08



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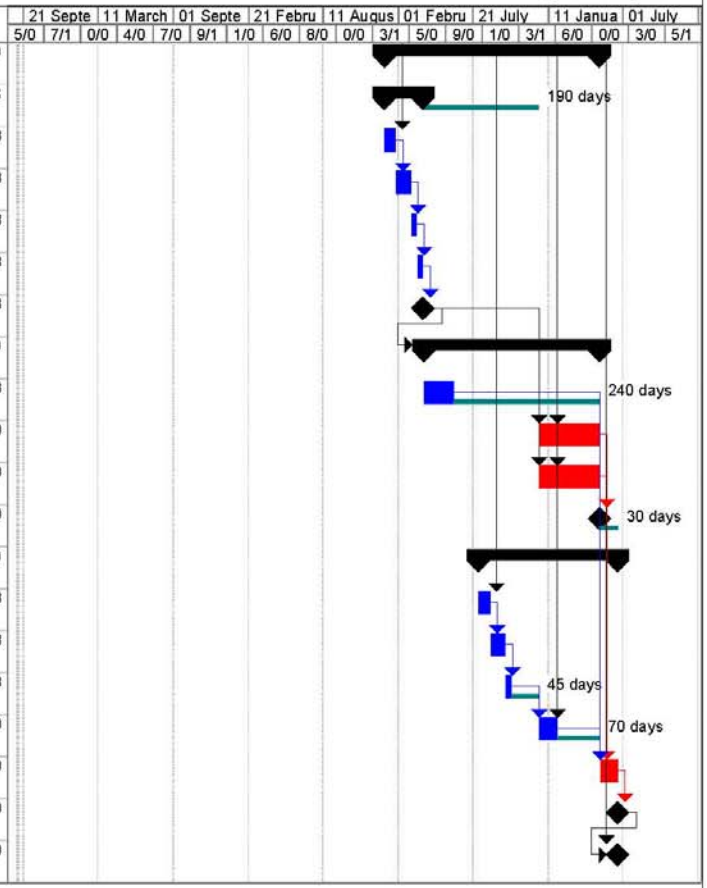
Nirex Geoscience Database System — High Level Project Plan

ID	Task Name	Duration	Start	Finish
93	**Application Development**	**355 days**	**Mon 31/12/07**	**Fri 08/05/09**
94	**Application Development Plan**	**65 days**	**Mon 31/12/07**	**Fri 28/03/08**
95	Application Development Proposal	20 days	Mon 31/12/07	Fri 25/01/08
96	Review (Nirex and Stakeholder)	25 days	Mon 28/01/08	Fri 29/02/08
97	Revise Application Proposal Following Review	10 days	Mon 03/03/08	Fri 14/03/08
98	Approve (Nirex)	10 days	Mon 17/03/08	Fri 28/03/08
99	Application Development Planned	0 days	Fri 28/03/08	Fri 28/03/08
100	**Application Development**	**290 days**	**Mon 31/03/08**	**Fri 08/05/09**
101	Develop Data Loading Applications	50 days	Mon 31/03/08	Fri 06/06/08
102	Develop Data Viewing Applications	100 days	Mon 22/12/08	Fri 08/05/09
103	Develop GIS Applications	100 days	Mon 22/12/08	Fri 08/05/09
104	Application Development Complete	0 days	Fri 08/05/09	Fri 08/05/09
105	**Testing**	**230 days**	**Mon 04/08/08**	**Fri 19/06/09**
106	Develop Test Plan	20 days	Mon 04/08/08	Fri 29/08/08
107	Review (Nirex and Stakeholders)	25 days	Mon 01/09/08	Fri 03/10/08
108	Revise Test Plan Folowing Review	10 days	Mon 06/10/08	Fri 17/10/08
109	Testing	30 days	Mon 22/12/08	Fri 30/01/09
110	Whole System Testing	30 days	Mon 11/05/09	Fri 19/06/09
111	Testing Complete	0 days	Fri 19/06/09	Fri 19/06/09
112	Project Complete	0 days	Fri 19/06/09	Fri 19/06/09



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