



JISC Final Report

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1 Acknowledgements

The Orbital project at the University of Lincoln gratefully received £241,505 of funding from JISC, for an 'infrastructure project' within the 'Managing Research Data' programme.

2 Project Summary

The Orbital project was a pilot project funded over 18 months to develop institutional policy, training and technical infrastructure for research data management (RDM) at the University of Lincoln. The project team included staff from the Centre for Educational Research and Development (CERD), the Library, the Research and Enterprise Office, and worked with researchers in the School of Engineering and the School of Computing to understand their needs for RDM. The Orbital project built on the experience and technical outputs generated by previous JISC-funded projects at Lincoln and employed two full-time web developers to examine the requirements, constraints and opportunities for the development of tools to enable and support RDM.

In retrospect, we can understand the progress of the project in six stages: (1) the first six months were spent learning the domain, when project staff developed their own expertise and reflected intensely on the requirements of researchers. (2) This led to the second stage, where we developed a 'Minimum Viable Product' based on our proposed Implementation Plan. (3) The third stage was marked by a significant shift in approach when we decided to adopt the CKAN software in place of our own product, leading to the development of the fourth stage of the project (4) during which we focused on systems integration and workflow for RDM. (5) This resulted in the final technical output of the project, the 'Researcher Dashboard' and the concurrent proposal for sustaining the work of the project through the formation of a new 'Research Information Service' at Lincoln (6). At the same time as this intensive technical work, institutional policy and RDM documentation and training were being developed.

The final outcomes of the Orbital project can be summarised as: establishing expertise among academic support staff; the development of a technical design and product which meets many requirements for RDM and can be further developed to meet future needs; a body of documentation and a programme of training for post-graduate students and researchers; the development of institutional policy for RDM; and the requisite Business Case for a Research Information Service, which underpins the Policy and develops a sustainable roadmap for RDM at Lincoln. This has led to the creation of a new post of Research Services Developer to continue the technical work undertaken during the course of the project.

3 Main Body of Report

The Orbital project's stated objectives were "to build on our previous work around the deposit, management and access to university research as well as further existing work in which we are building a platform for data-driven services at the university. Throughout this undertaking, we aim to improve our understanding of the issues around research data management; develop the requisite skills among the university community to better manage research data; re-use and develop some of the underlying tools we have built to provide an institution-wide service for the ingest, description, preservation and dissemination of research data; improve the way we work on such projects, refining our use of agile methods; build capacity for the local development of academic technologies at the university; develop and implement appropriate institutional policy for the deposit, management and sharing of research data; and develop a Business Plan for the university for the long-term sustainability of our research data." The remainder of this Report discusses and reflects on our achievements and lessons learned in relation to those planned objectives.

3.1 Project Outputs and Outcomes

What follows is a list of the 'Anticipated Outputs and Outcomes as stated in our Project Plan.

Output / Outcome Type <i>(e.g. report, publication, software,</i>	Brief Description and URLs (where applicable)
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<i>knowledge built)</i>	
A requirements analysis	An initial requirements analysis was created. The project team met with researchers in the School of Engineer every two weeks throughout much of the project. Two early Case Studies were written: https://github.com/Incd/Orbital-Core/wiki/Case-Studies
An implementation plan	An Implementation Plan for the technical infrastructure was produced. This included a Technical Specification, Literature Review, Data Assets Framework survey results, and a draft RDM Policy. http://orbital.blogs.lincoln.ac.uk/2012/04/05/implementation-plan/
Development and implementation of a pilot OAIS technical infrastructure for research data	A discussion of Orbital and the OAIS reference model was posted to the website: http://orbital.blogs.lincoln.ac.uk/2012/02/10/orbital-and-the-oais-reference-model/ An integrated technical infrastructure for research data has been designed and a working, pilot application has been produced. We have not yet mapped our design to the OAIS reference model to evaluate compliance.
Documented open source licensed code	All source code is openly licensed and documented: https://github.com/Incd/Orbital-Core [deprecated] https://github.com/Incd/Orbital-Manager [deprecated] https://github.com/Incd/Orbital-Bridge [current]
Mechanisms for managing and transferring data between institutional web services	The 'Researcher Dashboard' application ('Orbital Bridge') orchestrates the movement of data between all existing research information environments and includes a workflow for the researcher to deposit and catalogue research data. http://orbital.blogs.lincoln.ac.uk/2013/05/03/the-researcher-dashboard/
User documentation	Documentation has been written for RDM. The source code is fully documented and the design decisions are well documented on our website.
Support: Training workshops	RDM Training workshops for PG students have been running since January 2013. RDM training for staff is scheduled monthly from April 2013.
An institutional data management policy	A policy was drafted in April 2012 and presented to the university Research Committee. It was subsequently presented to SMT and to the College Research Directors. A final version is due to be presented to the Research Committee for approval, pending resourcing decisions. http://orbital.blogs.lincoln.ac.uk/2013/06/13/research-data-management-policy-approved/
A Business Plan for further development of the project outputs	A Business Plan for a new university Research Information Service was presented to SMT in January 2013. SMT recommended that the Dean of Research include it in the university's 'Annual Conversation' (resource allocation process). Subsequently, a grade 7 'Research Services Developer' post has been approved. Extracts from the Business Case were presented at the JISC MRD Programme final workshop https://orbital.blogs.lincoln.ac.uk/2013/03/28/team-meeting-notes-winding-down-tidying-up-moving-forward/
Contact with the DCC and other peer organisations	The DCC visited Lincoln in February 2013 and led a workshop that included staff from the Orbital project, the Library and Research and Enterprise Office. The workshop focused on Data Management Planning. http://orbital.blogs.lincoln.ac.uk/2013/05/03/data-management-planning/ Orbital developers are working with the DCC to integrate DMPOnline into the Researcher Dashboard application.

Contribution to JISC (and other related) events	We have attended all JISC MRD events as well as related DCC events ('roadshows' and RDMF). We attended Open Repositories 2012 and IDCC13. We are attending ELAG13 and IASSIST 2013 (May 2013). We ran a 'CKAN4RDM' workshop in March 2013. Details of all events can be found on our project website.
A conference/journal paper	We presented a peer-reviewed paper at Open Repositories 2012. We have had a paper accepted for presentation at IASSIST in May 2013 and invited to present a paper at the OpenAIRE/LIBER workshop, also in May. http://orbital.blogs.lincoln.ac.uk/2013/06/07/open-data-and-the-academy-an-evaluation-of-ckan-for-research-data-management/
A website, documenting the progress of the project	We have maintained an active website and blog throughout the project. http://orbital.blogs.lincoln.ac.uk
Experience/knowledge of the MRD domain	Staff from the Library, CERD, ICT, and Research and Enterprise have worked on the project and developed experience and knowledge of the MRD domain throughout this time. We are now experts in our institution and will disseminate this knowledge through internal training events and awareness-raising publications.
Build capacity and skills for the local development of data-driven services	Two developers have worked full-time on the project for 12/18 months. Although these developers will not be remaining at Lincoln beyond the life of the project, it has been disseminated to other staff in ICT and CERD. A new Developer post will be recruited in July http://orbital.blogs.lincoln.ac.uk/2013/06/12/come-and-work-with-us-on-research-data-at-lincoln-jiscmr/
Reflect on and refine our overall agile methodology for project management	We have worked in an 'agile' and open way throughout the project and reflected on this on our website. We have used and deployed tools to assist us in this approach e.g. http://orbital.blogs.lincoln.ac.uk/2012/02/10/the-toolchain-first-pass/ and http://orbital.blogs.lincoln.ac.uk/2012/03/08/understanding-and-participating-in-open-source-culture/
Final Project Report	http://orbital.blogs.lincoln.ac.uk/final-report

3.2 How did you go about achieving your outputs / outcomes?

The Orbital project was a joint project between staff working in the Library, ICT services, Research and Enterprise Office, the School of Engineering, and led by the Centre for Educational Research and Development (CERD). The project reported to a Steering Group of senior managers and academics and to the university's Research, Innovation and Enterprise Committee (RIEC).

Since 2007, CERD has undertaken a number of JISC-funded innovation projects, most of which were collaborations with the Library and ICT.¹ Due to the existing interests and enthusiasm of the people involved, Orbital was a development-driven project, building on a number of technologies that we had developed either in part of fully during previous projects. This shaped our approach and the decision to recruit two full-time developer posts for the project. It is also reflected in the recent approval to recruit a new 'Research Services Developer' post to sustain the work of the project as we develop the outcomes of Orbital into a new university research information service. We recognise that there are a number of ways that an RDM project can be approached, with particular weight being given to the

¹ Much of this work and a discussion of our approach has been written up in a Case Study commissioned by JISC
<http://www.jisc.ac.uk/whatwedo/topics/opentechnologies/openeducation/lincoln-university-summary.aspx>

development of people, policy or technical infrastructure. We worked across these areas, but undoubtedly gave more weight to the development of technologies for RDM. To begin with, a project plan and set of work packages were agreed and a schedule for monthly project team meetings, quarterly meetings with the Steering Group and reporting to the RIEC was agreed. We also arranged to join regular scheduled meetings of the research group in the School of Engineering, who were acting as our primary users on the project. In terms of overall project management, there were few other conventional formalities. Having an emphasis on software development, we were keen to adopt an 'agile' approach to the day-to-day running of the project and found the 'Crystal Clear' methodology an appropriate guide.²

Software development for the project was led by CERD, with both developers being recruited to work full-time in the Centre. The development of the Policy and Business Case, as well as overall Project Management was also led by CERD in close collaboration with team members from the Library and Research and Enterprise Office. The Library led the development of training workshops and supporting documentation. We also benefitted from a seminar led by Dr. Mansur Darlington from the University of Bath, who had previously run the ERIM project, which focused on RDM for Engineering.³

As described in section 2, the project can be retrospectively divided into six stages. The first stage consisted in learning and planning, resulting in our Implementation Plan (WP6), which was intended to be a synthesis of our initial user requirements gathering (WP5), an assessment of Engineering research data (WP9), an evaluation of standards and technologies (WP10), informed by a literature review of previous work relevant to the Research Data Management (RDM) domain as it relates the discipline of Engineering (WP4).⁴

The second stage of the project focused on the development of a 'Minimum Viable Product' based on our proposed Implementation Plan. This was an intensive period of software development that resulted in a minimal, working tool to upload, catalogue and publish research data.⁵ Developing software naturally requires a thorough understanding of the user requirements and overall domain and extended our initial process of learning about RDM in general.

The third and fourth stages of the project was marked by a decision to adopt CKAN, an existing open source data management system⁶, as the core technology for our project and focus on integrating it with existing research information systems at Lincoln. We called this work 'Orbital Bridge'.⁷

The fifth stage of the project was the development of Orbital Bridge into a fully integrated application, which we call the Researcher Dashboard.⁸ This implements a workflow for research project management, data management and data deposit and publishing.

The final stage of the project was the development of a Business Case for the Senior Management Team, which proposed a roadmap for research data management as part of a broader development

² Some reflections on working in an 'agile' way can be found on our project blog <https://orbital.blogs.lincoln.ac.uk/?s=agile> On Crystal Clear, see https://en.wikipedia.org/wiki/Crystal_Clear_%28software_development%29

³ Building on the ERIM and REDm-MED projects <http://orbital.blogs.lincoln.ac.uk/2012/02/07/building-on-the-erim-and-redm-med-projects/>

⁴ Implementation Plan <https://orbital.blogs.lincoln.ac.uk/2012/04/05/implementation-plan/>

⁵ A Minimum Viable Product for Research Data Management? <https://orbital.blogs.lincoln.ac.uk/2012/05/23/a-minimum-viable-product-for-research-data-management/>

⁶ Hello CKAN <http://orbital.blogs.lincoln.ac.uk/2012/08/17/hello-ckan/> Choosing CKAN for research data management <https://orbital.blogs.lincoln.ac.uk/2012/09/06/choosing-ckan-for-research-data-management/>

⁷ Orbital Bridge <https://orbital.blogs.lincoln.ac.uk/2012/09/04/a-bridge-to-the-skies/> See also Orbital deposit workflow <https://orbital.blogs.lincoln.ac.uk/2012/12/06/orbital-deposit-of-dataset-records-to-the-lincoln-repository-workflow/> Datacite workflow <https://orbital.blogs.lincoln.ac.uk/2012/12/05/orbital-ams-ckan-eprints-datacite/>

⁸ <http://orbital.blogs.lincoln.ac.uk/2013/05/03/the-researcher-dashboard/>

of 'Research Information Services' at Lincoln.⁹ This was accepted by SMT and a new post of Research Services Developer was approved to continue the technical development started by the Orbital project.

Throughout the project, we were concurrently working on the development of an RDM Policy¹⁰ and an on-going series of staff and post-graduate workshops on best practice for RDM.¹¹ The Policy is expected to be approved at a Research Committee meeting in Spring 2013.

Overall, we achieved all of our intended objectives (see Section 3,1), although as we discuss in the later sections in this report, much was learned during this process, which affected the resulting Service we are piloting.

3.3 What did you learn?

The Orbital project was the largest JISC-funded project that Lincoln has undertaken and although a 'pilot project', it provided a real opportunity to establish the foundations of a new type of research service at Lincoln.

The main lesson learned over the course of the project was that 'research data management' is an artificial construct that in practice cannot be so easily isolated from other existing aspects of the research project lifecycle. RDM is not simply one discrete part of this lifecycle but impacts on all aspects of a research project. This became clear very early on when we began to discuss RDM with researchers in the School of Engineering. Bearing in mind that at this stage, staff on the project team were also learning about what constitutes RDM, we had a tendency to talk about RDM as if it was a thing in itself, whereas researchers were more inclined to respond by talking about the management of their research projects as a whole, rather than just the data. For them, how they worked with research data affected their methods of collaboration, their choice of tools and even how they organised project meetings.

From this experience, we learned that the training, tools and policy that we were to develop, needed to reflect an appreciation that 'data' means not only different things to different people, but that it was unlikely that we could develop a single, all-purpose RDM tool that would serve everyone's needs. It was not our intention to try to impose new choices of research tools on researchers, but rather assist academics through the improvement of their existing processes.

This points to another significant lesson learned during the project: At what point does RDM intervene in the research lifecycle? From our experience of being part of the JISC MRD programme, we were made aware of the significance of data management planning, data curation and data publishing, yet our assumption, which was validated when talking with Engineers, was that tools, processes and good practices for 'research data management' can and should be available during the data collection and analysis phase of the project – what became known as 'active data' during the course of the MRD programme.

So, it became clear to us that Research Data Management was not simply a planning and curatorial exercise, but overlaps with the requirements for Virtual Research Environments and the use of disciplinary specific data analysis tools. The design of Orbital was always meant to accommodate this, through the development of APIs for data ingest, visualisation tools for data analysis and a data store for active data being worked on. It was partially due to these three requirements that led us to adopt CKAN as the central component for RDM, due to it having all three features. This is discussed at length on our project blog, but in summary we shifted from the development of a research data management infrastructure to the development of a research information service, which was extensible due to careful design and choice of technologies and protocols.

⁹ The Research Service is discussed here <http://orbital.blogs.lincoln.ac.uk/2013/03/28/team-meeting-notes-winding-down-tidying-up-moving-forward/>

¹⁰ Drafting a Research Data Management Policy <http://orbital.blogs.lincoln.ac.uk/2012/04/02/drafting-a-research-data-management-policy/>

¹¹ Blog posts on 'training' <http://orbital.blogs.lincoln.ac.uk/category/training-2/>

This shift to a 'research information service' proved beneficial when writing the Business Case for SMT, as it was much more meaningful to discuss an integrated research service, combining grant award management, bibliometrics, data management, curation and publication, than simply research data management. We were also assisted by the university's preparations for the 2013 REF, because through improvements the Orbital project was making to the university staff profiles, the contribution of project staff to the upgrade and development of our institutional repository, our aggregation of research-related information, and our understanding of bibliometrics, we were able to demonstrate that such oversight, experience and vision for an integrated Research Information Service was both necessary and beneficial to the university, not least in the run up to the REF.

3.4 Immediate Impact

The immediate impact of the Orbital project has been to embed the idea of research data management into the fabric of the university. Key staff in the Library, ICT and the Research and Enterprise office are now familiar with the meaning of the phrase and its implications. Similarly, discussion around RDM has been had at all levels of management in the university, including PVCs and College Research Directors, in a way that wasn't the case 18 months ago.

Furthermore, post-graduate staff and academics are slowly becoming more attuned to both the requirements and benefits of RDM. Regular training sessions are available, as is online documentation.

The institution-wide implementation of the Orbital software ('researcher dashboard' and CKAN) has not yet been undertaken. Orbital was a pilot project and we have tested the workflow and software on a small number of users. We intend to first create a roadmap for Research Services at Lincoln, as well as recruit a Research Services Developer to develop and maintain the technical infrastructure before we invite all researchers to use it. However, the technical infrastructure is in place and tested.

The Orbital project was also the first time that agile software development practices were genuinely practiced at Lincoln. Similarly, the re-use and production of open source software¹² was a key aspect of the project and these new working practices¹³ (e.g. the use of 'continuous integration')¹⁴ have been adopted in part by other staff. We hope to make more use of agile methods in the future.

Specifications for the storage of research data are a key component of a new study by central ICT services as they scope the university's use of cloud services. This is a formal, funded consultation exercise, which the Orbital project manager is involved in. It is expected to lead to the provision of improved storage for research data by the end of 2013.

Finally, we have an RDM policy, a new Steering Group for Research Services and a commitment to better understanding the needs and working practices of researchers. These were not in place prior to the Orbital project.

3.5 Future Impact

The development of a Research Information Service, led by The Library, will be the long-term legacy of the Orbital project and co-ordinate all aspects of RDM training and support, the development of the technical infrastructure and the integration of RDM with work around scholarly communications and bibliometrics. At the time of writing, a new post of Research Services Developer has been approved and a Subject Librarian's post has been revised and re-graded to incorporate responsibility for this new research service.

A new Research Services Steering Group, reporting to the Research and Enterprise Committee, has been formed to lead the creation and implementation of a roadmap for improved research services at

¹² <https://orbital.blogs.lincoln.ac.uk/2012/03/08/understanding-and-participating-in-open-source-culture/>

¹³ <https://orbital.blogs.lincoln.ac.uk/2012/02/10/the-toolchain-first-pass/>

¹⁴ https://en.wikipedia.org/wiki/Continuous_integration

Lincoln. Furthermore, an annual (DAF-based) survey¹⁵ has been approved of all academic staff so as to measure the needs of researchers and the impact that this new service is having on the research community at Lincoln.

From a technical point of view, the Orbital project has developed new software ('Researcher Dashboard'), established the use of CKAN for RDM, and integrated disparate research information systems for the first time. We can now take a holistic view of research information and research data at Lincoln, which will improve our understanding of the research community, as well as improve business intelligence and make concrete connections between researchers, projects, grants, data, outputs and metrics.

4 Conclusions

Our perception of Research Data Management at the end of the Orbital project is that it remains **an emerging practice** that will mature over the next five years or so with new technologies, standards and processes emerging, as well as new institutional roles, such as the 'data scientist' becoming much more common.

Our approach was weighted towards the technical considerations of RDM and its implementation within a post-1992 university, where much of the research can be characterised as 'long-tail' and often unfunded. Lincoln is an ambitious and continually improving institution and there is much emphasis on increasing research activity overall. RDM practices need to be incorporated within a developing **overall research environment** that during 2012-13, is especially focused on the requirements and imperatives of the REF.

Our work on Research Data Management has forced us to reconsider research information in all its forms throughout the research project lifecycle, from grant application to scholarly dissemination, and this has been reflected in our attempt to integrate disparate systems and **aggregate research-related information** into a data warehouse upon which Orbital and other applications can be built and reporting can be undertaken. For example, the Orbital project made a significant contribution to the development of a new staff directory, the canonical public website for staff at Lincoln.¹⁶ The underlying data is being provided and enriched by data that Orbital has aggregated from other systems such as the Awards Management System and Institutional Repository. Undertaken properly, RDM requires the management and enrichment of all such data and it is difficult to proceed with the development of an RDM infrastructure without concurrently tackling the development of a number of systems.

From early on in our project, it became difficult to distinguish between **RDM and VRE requirements**. While we spoke to researchers about 'RDM', they often replied in terms of Virtual Research Environments. We are aware of the research done around VREs in the HE sector and the assumption that no single VRE is appropriate for all types of research. We feel that this is the case for RDM, too, and that in developing a technical environment for RDM, it is essential that the design and architecture be extensible and that subject-specific tools can 'plug in' to a generic RDM infrastructure as required. Similarly, the RDM infrastructure should be scalable so as to accommodate future research projects of different sizes as well as the overall growth in data accumulated.

On this last point, it remains unclear to us **how institutions will fund RDM**. The costs of curating, preserving and making accessible a growing volume of research data are not insignificant and there is currently no clear guidance from funders on what assistance institutions can expect to manage data long-term. At present, it looks like strict curatorial processes and a robust retention and disposal policy will be essential to managing the anticipated 'data deluge'. The benefits of data citation¹⁷ and the assumption that the sharing of data will lead to greater wealth being produced within society is difficult to turn into a business case for RDM, although evidence is beginning to emerge and no doubt this will become clearer to the academic community over the next few years as practices change.

¹⁵ <https://orbital.blogs.lincoln.ac.uk/2012/04/30/data-assets-framework-survey-summary/>

¹⁶ e.g. <http://staff.lincoln.ac.uk/jwinn>

¹⁷ <http://www.mendeley.com/groups/2879161/data-citation-benefits-studies/>

5 Recommendations

Recommendation 1: Synthesis JISC funded activity from across the MRD, VRE and Institutional Repository programmes. What areas of overlap are there? What lessons can be learned?

Recommendation 2: Survey the RDM technical landscape so far and invest in the development of one or two clearly emerging systems of choice.

Recommendation 3: Undertake work on the development of new roles e.g. data scientist, data curator, etc. Provide example Job Descriptions for institutions to re-use and case studies that illustrate the nature and benefits of these new roles. Is there a need for intensive professional training, such as the DCC have run over the last few years?

Recommendation 4: Continue to fund and support the Digital Curation Centre as the national centre of expertise. Throughout the MRD programme, their input and support has been invaluable and the DCC website is by far the best collection of resources for RDM.

6 Implications for the future

The Orbital project has produced a bespoke 'Researcher Dashboard' application based around a number of disparate systems. The code¹⁸ for this application is licensed under the AGPL and can be re-used by other institutions. However, it is not a turn-key solution for any university and it is likely that some of the design features and code will be of benefit to other projects rather than the entire codebase. In particular, the integration between CKAN, Datacite and EPrints should be of interest to other institutions. Once we have recruited a person to the Research Services Developer post, we intend to continue to develop the work started by the Orbital project. The securing of this post has been essential to the sustainability of work piloted by our project.

The Project Manager is keen to continue to investigate and encourage the use of CKAN for RDM. He has held a workshop, which was attended by over 40 delegates,¹⁹ is presenting a paper at two conferences in May 2013²⁰ and has set up a mailing list with the Open Knowledge Foundation to continue this work.²¹

Similarly, we have developed a RDM policy for the institution and agreed upon on new Steering Group to oversee a roadmap for RDM and research information in general at Lincoln. This Group will report to the Research and Enterprise Committee and aims to have a full service for RDM in place by May 2015 in line with the EPSRC expectations.

The new Research Information Service at Lincoln will be a cross-department initiative, led from the Library, and as such the Orbital project has transferred 'ownership' of Research Data Management to a major stakeholder with a strong interest in the future development of our work.

¹⁸ <https://github.com/lncd/Orbital-Bridge>

¹⁹ <http://orbital.blogs.lincoln.ac.uk/2013/02/27/ckan-for-rdm-workshop/>

²⁰ <http://www.iassist2013.org/program/sessions/session-b2/#c203> &

<http://www.openaire.eu/component/content/article/450?lang=en>

²¹ <http://lists.okfn.org/mailman/listinfo/ckan4rdm>