Organising an effective maintenance plan for Big Stuff

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Abstract: *Large technology objects need regular maintenance, but their size and complexity make them particularly challenging to manage. This paper outlines some of the key aspects which shape the large technology maintenance program at the Australian War Memorial, as well as some of the strategies that have been developed to increase its efficiency and effectiveness.*

Introduction

It has been recognized for some time that it is necessary to develop and implement ongoing maintenance plans for large technology objects (Paine, 1994). At the Australian War Memorial we have been running a regular maintenance program for some of our larger working objects for several years and in the past two years have reviewed and expanded this program to increase its effectiveness and the number of objects it covers. The review process has both clarified our ideas about what is required to implement such a program successfully and driven the development of some practical organisational tools for the program.

A maintenance program can be very unattractive to management and sponsors. It is a never ending project, it rarely has outcomes which will attract the media and, because it mostly maintains the status quo, it can be hard for them to see exactly what they are getting for their money. A maintenance program can also be a daunting thing to run, and for similar reasons. It is a never ending project, so it is hard to identify milestones to generate enthusiasm and a sense of satisfaction in staff and volunteers. It can seem hard to quantify – resources are spread over lots of objects simultaneously and it is hard to estimate the individual cost of maintaining each one. And it is easy to lose focus amongst a large collection of objects – priorities can be difficult to identify, and while you have an object out, it is tempting to do **all** the remedial work it needs, as well as just the maintenance required to keep it in its current condition.

Faced with these challenges, we have been developing a “conservation engineering” approach to the planning and implementation of the Memorial’s large technology maintenance program. This approach aims to reduce the uncertainties in the program, to make the program reliable and predictable and to give it clear annual targets. A certain level of “mass-production” has been adopted to reduce the amorphous mass of maintenance tasks to groups of similar jobs. Good record keeping is being used to underpin sound approximations of the time and money required to maintain similar types of objects with similar requirements. Contingencies are being built into estimates to allow for the unexpected – the vagaries of objects with unusual life histories and unforeseen internal problems. The case-by-case nature of conservation is thus accommodated within a planning framework based on broad knowledge and experience. This minimises the risk

of time and budget overruns and maximises the number of objects which can be actively monitored and maintained with the resources available.

This paper outlines some of the particular challenges faced in caring for the Memorial's large technology collection, and some strategies we have developed to meet those challenges.

Features that shape our maintenance program

The three features that seem to be most critical in shaping the Memorial's large technology maintenance program are:

- ⇒ It involves lots of people;
- ⇒ It involves lots of objects;
- ⇒ It is a long term project/commitment.

These three aspects may seem obvious, but their ramifications influence how we must design and manage our maintenance program to make it effective and sustainable.

Lots of people involved:
Our maintenance program does not just involve one person working closely with one particular object, it involves a number of people all doing their bit on lots of objects every so often over many years. This has some advantages – which can be used - and some disadvantages, which must be catered for.

The advantages of using lots of different people in a maintenance program are that you have more labour time available and that the routine and grubby jobs can be spread around rather than falling to one or two people. The disadvantages of using lots of people are that most of them will lack familiarity with the objects and you can get a "Chinese whisper" effect – information gets muddled or lost during the regular handovers from one person to another.

A lot of the work required is relatively routine and often grubby – visual inspection, cleaning, changing oils. While there needs to be supervision from a skilled mechanic or conservator to ensure the work is done correctly, many maintenance tasks are ideally suited to junior staff or volunteers, who need training before attempting more complex tasks. This is an advantage - routine jobs get a labour force to do them and the labour force gets increased skills – but it results in the disadvantage of a high turnover of participants in the maintenance program, all with minimal familiarity with the objects.

Lots of objects involved:
Our maintenance program currently covers about 27 functional objects, as well as cleaning and monitoring of all large technology objects on display. We are progressively working towards maintenance of functionality for a further 8 objects, as well as static maintenance (cleaning, monitoring and maintaining stability) for all the remaining large technology objects in the collection. Maintenance as necessary will also be programmed for any new acquisitions. Overall we have approximately 200 large artillery pieces in our

collection, as well as 200 other objects, including aircraft, vehicles, watercraft, electrical equipment such as searchlights and radar. Maintenance for these objects involves a range of tasks, from simple cleaning and monitoring to full operational display maintenance. It must be noted that we distinguish between "operational display maintenance" which ensures that an object will function reliably at very short notice, from "operational maintenance" which ensures that an object can still function but may take considerable time and effort to get going and troubleshoot. This is an important distinction, as operational display maintenance is much more resource intensive.

The advantages of maintaining lots of objects are that you can develop efficient, "production line" practices, buy consumables in bulk, justify improvements to equipment and facilities and generate a high profile for the program. The disadvantage is that it is relatively easy to forget the specific needs of individual objects.

Long time period:
Maintenance on each large technology object is intended to continue for as long as the object is retained within the collection. Looking at this the other way round, this means that as long as the Memorial owns large technology objects it requires a maintenance program. The resources devoted to the program will vary according to the number, type and usage of those objects, but the need for and existence of the program remain constant.

The advantages of maintaining objects over a long time period are that you can monitor the effectiveness of specific products and practices in the long term and develop a large body of corporate knowledge about the objects. Again, the disadvantage can be that you can forget the specific needs of individual objects.

Practical measures

Planning
Maintenance plans for individual objects and the collection as a whole must inform each other but need to be distinct entities. Maintenance plans for individual objects must be done as a part of the initial assessment and preparation of the objects - preferably when they enter the collection but sometimes as part of a project to address a backlog of undocumented items within the collection. The collection level maintenance plan must be undertaken as an explicit exercise which uses and builds on these object level plans – a collection level plan will not rise out of a collection of individual object plans automatically.

- **Specific object maintenance plans** – each object should be brought into the work area for:
    1. inspection;
    2. condition reporting;
    3. assessment of significance and intended role in the collection (including whether it is intended to operate any of the object's functions and if so which ones);

4. development of a usage plan (how often will it be used, under what conditions, any critical points to be observed, etc);
5. photography;
6. cleaning;
7. urgent treatment to make the object stable, safe and maintainable (further treatment required should be documented but deferred until the object is identified as a priority for allocation of resources).
8. Development of a maintenance plan using information from all the above processes.

All the documentation compiled through the above processes, as well as the object's maintenance plan, must be placed on the object's file or database record. In addition the maintenance plan should be kept physically on or in the object for quick and easy reference.

- **Collection level maintenance plan** – this must be developed using the following information:
  - ⇒ number, general condition and intended role of all objects to be covered by the plan (derived from the object documentation and maintenance plans developed for each object);
  - ⇒ critical issues to be addressed, eg hazards, legal compliance requirements, major environmental problems – these critical issues will of course be the highest priorities for the maintenance plan to address;
  - ⇒ synergies between objects and projects, which can be exploited;
  - ⇒ forward projections of costs of maintenance plan;
  - ⇒ upcoming projects within the museum;
  - ⇒ physical facilities and equipment available for maintenance;
  - ⇒ people available – numbers, skills and availability;
  - ⇒ stakeholder requirements;
  - ⇒ areas needing research;

  The collection level maintenance plan must be tailored to the resources available, but also indicate where those resources are inadequate and what plans there are to increase/improve them. It must include an assessment of the current funding situation and ideas for how further funding may be obtained if necessary.

  The collection level maintenance plan should be written down, placed on the relevant file and reviewed annually before the projects and budgets for the next financial year are decided.

- **Resource planning**

  To successfully attract sponsorship or budgets for additional resources (or even continuation of the existing level of resources) it is necessary to do some preparation. The resources used in maintenance work (time, consumables, equipment, facilities) must be recorded and used to develop good estimates of

the annual cost of maintenance for each large technology object. These estimates can be used to calculate and justify budget bids for existing collections, and estimate the cost of maintenance for new acquisitions and new displays. With this information you are in a position to offer management informed choices – if they need to increase maintenance requirements (for example through new acquisitions), they can either increase resources to match (using your cost estimates) or accept a drop in the quality and reliability of preservation and display outcomes due to reduced maintenance per object.

Standardisation

To overcome problems associated with a lack of knowledge about the collection and initial lack of skills required for maintenance, we have found it valuable to standardise things wherever possible. Standard tasks and standard formats for information minimise the time people have to spend working out what needs to be done and minimise the mistakes made in interpreting the information.

- **Standardised tasks**

Complex or non-standard tasks demand skill and initiative; standard tasks demand patience, care and time. Senior, experienced staff are usually most efficiently used for complex tasks; junior staff and volunteers are generally the best resources for standard tasks (though there are of course exceptions to every rule).

Senior staff are usually at a premium, so it makes sense to ask whether there is anything that is currently complex that could be made standard. Once people are familiar with a standard task, they can do it on every object that requires it, with minimal supervision.

An example of the conversion of a complex task to a standard one is the maintenance of tyre pressures for Memorial objects. A dull, fiddly and time consuming job, senior staff were required to do it because each wheel/tyre required expertise to judge the amount of pressure suitable for its type, condition and whether it was actually used to support the object or not (many objects are stored and moved using axle supports instead of their wheels). The solution was to use senior staff time over a short period to provide the expertise to make the job simple, standard and efficient. Each wheel/tyre was inspected and a suitable pressure determined. A tyre maintenance sheet was drawn up for each object (see Appendix A) with a clear diagram showing the recommended pressures. The valve on each tyre was checked to ensure it was a standard fitting and worked correctly. A tyre maintenance trolley was assembled, containing an accurate tyre gauge, a small portable compressor, instructions for using the compressor and useful items such as a torch and writing materials. While senior staff still provide periodic input to check that all is working well and the recommended pressures are still appropriate, the result is a job which is quicker, easier, less frustrating and largely appropriate for a lower skill level.

Maintenance at the Memorial is standardised into a rolling system of increasingly in-depth 3 monthly inspections. “A” surveys focus on visual inspection and surface cleaning. “B” surveys involve visual inspection and surface cleaning, plus exercise of all functional systems. “C” surveys involve the same tasks as in “A” and “B” surveys, plus grease and fluid changes and fluid sampling for analysis if required. Familiarity with these regimes means that junior staff and volunteers can proceed with less complex tasks with minimal supervision, while seeking guidance from senior staff for the more complex aspects of the surveys.

- **Standardised documentation**

Document work done in simple, quick ways using standardised formats. This prompts people to provide the information which is needed with minimal effort, and makes it easier to locate and compare information between reports. For instance, once people are familiar with the format of a standard maintenance plan, they will know exactly where to look for the critical object specific information within it. The following are examples of standardised LTO forms used within the Memorial[1]:

- LTO maintenance schedule
- LTO routine maintenance information sheet
- LTO routine maintenance plan
- LTO maintenance and movement log sheet
- A maintenance survey sheet
- B maintenance survey sheet

- **Standardised (quick and easy) scheduling and reporting**

The Memorial uses a spreadsheet schedule which allows known dates and commitments to be plugged in several months ahead[2]. As the work is done it is ticked off in some manner (this will depend on whether you are using a hardcopy or electronic version), making it easy to use the spreadsheet to assess progress, identify shortfalls and generate monthly/quarterly/annual reports.

- **Maintain databases of collated reference information:**

It may be useful to maintain spreadsheets recording similar information about each object – spares required, fuels, lubricants and coolants, authorized operators etc. This information provides a quick “look-up” table to help you estimate requirements for bulk orders or people to call in case a scheduled operator is unavailable for an event. However, this format requires time to maintain and is only really effective for information you need to view over a cross section of the collection – everything else is more efficiently accessed by just looking up the records for a particular object.

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[1] These forms may be used as templates. To obviate difficulties with use/formatting on different systems, they are provided in both Adobe pdf format and in Word for Windows format as separate documents in the “Practical Tips” section of the preprints.

[2] A copy of this spreadsheet is included in Adobe pdf and Excel formats in the “Practical Tips” section of the Preprints and may be used as a template if the sample data is stripped out.

Conclusion

The optimisation of the Memorial's large technology maintenance program is a work in progress – we still have a lot more reorganising to do. While we have some good procedures in place, we have not yet combed through the program as a whole to ensure that each element dovetails with all the others in the most efficient way and that our suite of forms for documentation has a co-ordinated presentation and does not duplicate information unnecessarily. The process of optimization is also an ongoing one – every maintenance program needs to be regularly reviewed to ensure that it evolves to meet the needs of an evolving institution and collection. However the ideas outlined above are a start, and have proved very effective in enabling us to meet the challenge of using a lot of different people to care for an awful lot of Big Stuff.

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References

Paine, C., editor, *Standards in the museum care of larger and working objects: social and industrial history collections 1994*. Museums and Galleries Commission, London, 1994.