

Report on the use of Handheld Technology in Museums

Over the past few years, there have been large leaps forward in the capabilities of handheld computers. Several museums and galleries throughout the world have begun testing this technology in order to gauge its usefulness as a tool to complement exhibitions and engage visitors.

As a result of these developments and the ever-increasing popularity of handheld devices such as PDAs and MP3 players, it seems necessary that the Australian Museum look into current developments in handheld technology and what issues need to be considered if the Australian Museum was to implement a handheld program.

This report has been compiled as a result of an extensive web search as well as feedback from an email which was circulated to colleagues on a visitor studies group email list. Definitions of key technological terms are set out, followed by the details of some current trials of handheld technology in museums and galleries overseas. Sections 3 and 4 look at other technological developments, which could potentially be useful in complementing exhibitions and sparking visitor's interest. Key observations from the trials are discussed in Section 5, followed by some possible definitions of E-learning. Section 7 looks at some different PDAs that were used in the various handheld trials, while Section 8 looks briefly at two current digital programs at the Australian Museum. Lastly, Section 9 concludes as well as laying out some recommendations for the Australian Museum in terms of handheld programs.

1. Definitions of key technical terms

PDA: Stands for Personal Digital Assistant, and is 'a handheld device that combines computing, telephone/fax, Internet and networking features. A typical PDA can function as a cellular phone, fax sender, Web browser and personal organizer.' (www.ask.com) PDAs can be **Bluetooth** or **WiFi** enabled.

MP3: Short for MPEG Audio Layer 3. It is an audio compression format. MP3 can take longer audio recordings and shrink them down to a fraction of their size while using little if any fidelity of sound. **iPods** are MP3 players (amongst other functions).

Bluetooth: A wireless way for electronic devices to communicate with one another. It is a radio frequency standard 'developed by a group of electronics manufacturers that allows any sort of electronic equipment

to make its own connections, without wires, cables or any direct action from a user.' (www.electronics.howstuffworks.com)

WiFi: A wireless network which uses radio technology to enable electronic devices to communicate with each other, similar to Bluetooth. There are a few standards of WiFi, the most reliable and high quality being the 802.11g standard.

Hypertag: Short range wireless devices that can be mounted on walls etc which can send information to mobile phones or PDAs via infra-red or Bluetooth; small in size.

2. Current Trials and Usage

The most current and useful overview of the state of the use of handheld devices in museums and galleries is Chris Tellis's comprehensive paper entitled 'Multimedia Handhelds: One Device, Many Audiences' from the Museums and the Web 2004 Conference (<http://www.archimuse.com/mw2004/papers/tellis/tellis.html>).

Institutions which Tellis mentions and which are also discussed here are marked with *. He also discusses the J. Paul Getty Museum and The Royal Institute.

2.1 Multimedia Tour Program at Tate Modern* www.tate.org.uk/

In 2002 Tate Modern began trialing a system of handheld computers connected via a wireless network to a central server. The 802.11b WiFi network was specially installed in the gallery for the purpose of providing visitors with access to 'multimedia information, communication and access to database-stored texts' ('Multimedia Tour Program at Tate Modern', Gillian Wilson, paper delivered at Museums and the Web Conference 2004: 1). By 2004, Tate Modern had developed a program consisting of three multimedia tours appealing to a range of visitors. The *Multimedia Highlights Tour* is aimed at the 16-25 age group and covers a selection of 19 artworks. Using PDAs, visitors can augment their viewing experience by accessing 'audio, video, image and text, as well as interactive features such as games and interaction between visitors' (Wilson 2004: 3). A notable feature of this tour is the Tate txt messaging function which allows visitors to communicate between individual PDAs. The *British Sign Language Tour* is aimed at the hearing impaired and contains video clips of a BSL interpreter signing information about selected works in the collection. The *Collections Tour* is aimed at the widest audience, allowing the visitor access to information about approximately 300 artworks in the collection displays. For this tour, the PDAs are linked back to the

central Information Management System to access textual information about the artworks. In the tours, visitors select the artwork they're viewing and then options from a menu on screen to give them more information or play a video clip about the artwork for example.

The technology that Tate chose to trial consisted of 25 Toshiba e750 PDAs, and some e800s (see section 7.1); these include integrated wireless cards which improve system stability and responsiveness, and included headphones. The operating system used was PocketPC 2003, with the content programmed in Macromedia Flash, version 6, which is triggered via a Flash projector file to run in the Antenna Media Player (no need for cables). Tate worked with Antenna Audio which produced the Antenna Multimedia System that resides client and server-side and operates with the Proximity Platform from PanGo Networks, in other words, the network picks up where the visitor is in the gallery and sends the appropriate information to the PDA. The server computer was a Toshiba Magnia 300 Series (Wilson 2004: 13).

In evaluating these trials, Tate Modern found that on the whole it improved visitor experience. They found that 'audio commentary accompanied by visual images [to be] a highly popular strategy for engaging visitors with artworks included in the tour' (Wilson 2004:8). Also they found that visitors were 'positive about the video clips used, as long as they [were] short and directly related to what they [were] looking at in the gallery space' (Wilson 2004:9). Interactive games were also found to be successful in prompting and encouraging the visitor to think more deeply about particular works. Many visitors who were not used to visiting galleries found the PDAs helpful in guiding them around a space with which they were unfamiliar. On the other hand, some visitors wanted more choice about which works they looked at; they were concerned they were missing out on works that weren't in the tour (Wilson 2004).

Some negative points from the tours were that the headphones cut visitors off from one another, especially if they were visiting in a group. Also, small technical faults such as delays in images appearing on screen meant that attention was drawn away from the artwork and towards the technology, which was not Tate's aim. However, constant improvements in PDA technology mean that this will not be a large problem in the future.

Importantly, Tate Modern was supported in their trials of this technology by Bloomberg and Toshiba, who provided funding and hardware for the program. It is understood that these trials have now stopped and the Multimedia Tour Program has been properly implemented.

Link to paper

<http://www.archimuse.com/mw2004/papers/wilson/wilson.html>

[As an interesting aside: Steve Yalowitz, the evaluator from the Monterey Bay Aquarium emailed us about his experiences at the Tate Modern. This is what he said:

“Funny you should mention the Tate Modern. I was in London for some consulting in February and took the Tate Modern's new handheld tour. It worked really well for me, in large part because I was visiting alone and looking for some help interpreting the works. There were also some really neat functions, like playing "games" and watching video. The promise was that you bookmarked all these different art pieces then when they downloaded it at the end of your visit they were supposed to email you a link to your specific information. Here's the problem: not only did the links they sent me not work, but when I replied to the email about the problem it got bounced back. Just now I got curious, found my email and the links now work (bug fixed!). But if I weren't in the museum world I probably would have grumbled and deleted the email.”]

2.2 Blanton iTour at the University of Texas www.blantonmuseum.org/

This was an experiment organized by the Blanton Museum of Art at the University of Texas in 2003 to discover whether ‘handheld multi-media technology [can] enhance visitor learning’ (‘The Blanton iTour – An Interactive Handheld Museum Guide Experiment’, Anne Manning & Glenda Sims, paper delivered at the Museums and the Web Conference 2004: 1).

To test this, the Museum planned a small exhibition consisting of only 4 artworks. The study lasted three months and was funded by the National Endowment for the Humanities. For each work of art a text component was created as well as video/audio and creative play components. These components were stored on 5 Compaq iPaq Pocket PC 3670s, 3 Dell Axim X5s and 2 Toshiba e750s (see section 7) which had been provided by the University of Texas and Microsoft Research, and considering the small size of the exhibition, all the data was stored in the PDAs. Two-ear and single-ear headphones were also experimented with; the two-ear headphones proving to be the more popular option with visitors.

On the whole, it was found that visitors who used the iTour as opposed to those who did not, spent more time in the exhibition and engaged with the artworks in a positive way (Manning & Sims 2004: 7). They were able to ‘describe the works using more detail[...]demonstrate a deeper level of understanding and critical thinking[...]make more connections to their own history and background and engage in greater personal learning’ (Manning & Sims 2004: 8-9).

The positive findings of the experiment were similar to what Tate Modern discovered in its trials of handhelds, in that visitors liked the 'self-paced and self-directed elements, the opportunity to see and hear the artists talk about their work [as well as] the ability to observe the works while listening to the audio content' (Manning & Sims 2004: 12). Blanton Museum of Art also found that the PDAs were easy to use, even for very small children and visitors very unfamiliar with computers.

Link to paper:

<http://www.archimuse.com/mw2004/papers/manning/manning.html>

2.3 Te Papa* www.tepapa.govt.nz/

Te Papa Tongarewa is currently conducting a three-month trial of 12 Ipaq touchscreen handheld computers in conjunction with their Made in New Zealand exhibition, which will run until September. The trial has come almost a year after it was envisaged to start (Tellis 2004: 12), so that the museum could take advantage of technological advances. Interestingly, Te Papa is one of the few large institutions trialing handheld technology that is not purely an art museum.

However, Te Papa is taking a similar approach to Tate Modern, with the 'mobile exhibition guides' allowing visitors access to 'interviews, animation, interactive games and audio commentaries relating to 24 items in the exhibition' (Reuben Schwarz, 'A curator in the hand', article from *The Dominion Post* 13/6/05). The aim of the trial is to test who uses the handheld computers and 'whether they can be successfully used as an interpretive tool that enhances the visitor experience' (Schwarz 13/6/05). Visitors can request that extra information on exhibits be emailed to them by touching a flag icon on the screen during a presentation.

Unlike Tate Modern's multimedia tours in which content is stored on a central server and delivered via a wireless network to the individual handheld devices, Te Papa is storing their guides on a memory card in each handheld device; advances in technology have allowed them to do this.

In developing the tour, the museum worked with Microsoft, who developed the software for the tour and have supported the trial. The museum staff use Microsoft's Content Management Server to design and update the tours. Hewlett-Packard, Microsoft and Te Papa are sharing the cost of developing the mobile exhibition guides, which is around \$150 000.

Link to article

<http://www.stuff.co.nz/stuff/print/0,1478,3310837a28,00.html>

2.4 Fitzwilliam Museum, Cambridge www.fitzmuseum.cam.ac.uk/

In late 2003, this museum began testing a slightly different style of technology. PDAs with headphones were utilized in conjunction with Hypertags in a version of a wireless tour system called the Magus Guide (see www.hypertag.com). As of April 2005, the trials seem to still be happening. The small, unobtrusive Hypertags are mounted next to artworks and when visitors feel like they want more information about an artwork they point their PDA at the Hypertag and touch a button on the screen. A menu appears and the visitor can choose from 'audio, interviews, videos, animation, images and comparisons with other objects in the museum' (Catherine Rose, 'Back to the Future – High Tech History at Fitzwilliam Museum' article from *24 Hour Museum*, 15/4/05) to enhance their museum experience. The options given to the visitor are actually web links, so the Hypertags have the advantage of being instantly and very easily updateable. The museum can choose to connect visitors with material from the museum, or direct them to any other relevant websites. Visitors can also bookmark lists of sites and email them to themselves so that they continue learning after leaving the museum.

An important feature of Hypertags is that they are or very soon will be compatible with most mainstream mobile phones, meaning that in future museums could even phase out PDAs. Doing this however would depend on the type and style of content that the individual museum wanted to deliver to their visitors.

Visitors found the Magus Guide to be a positive addition to their experience of the museum (Rose 15/4/05), which on the whole made their visits more interesting. The Magus Guide has also been tested in St John's College, Cambridge.

3. Specific 'museum' programs

A program that has been designed for museums of science, art, industry and culture is MosaicNet, which is used with the **Wivid** system (Wireless Visitor Interface Devices). MosaicNet is 'a modular package of licensable content... that includes interactive experiments, time-lines, and images which can all be customized for specific purposes' (<http://www.wivid.com/components/MosaicNet.html>). Visitors use a specially configured PDA to access information on the exhibitions as well as being able to do things like purchase tickets for film screenings at the museum. Visitors can also keep track of where they and their friends are. Content is modified centrally, via the internet by a museum staff member. It looks to be quite a good system however the specific technical details of the PDAs used are not on the website. The Smithsonian Institute is said to be about to

launch a program using Wivid, therefore evaluation of that should not be too far away.

4. Other potentially useful developments

4.1 *Podcasting*

Podcasting is a free service which allows users to download audio files from the internet in MP3 format. This is possible with any MP3 player, not just iPods. Users subscribe to a podcast and audio files are then downloaded onto their computer however often they wish. When the MP3 player is docked with the computer, it is updated with the latest podcasts which have been downloaded. In effect it allows users to create their own radio station if they want, and listen to whatever they like without commercials, although mainstream radio stations are quickly picking up on Podcasting's popularity and are producing some podcasts.

The benefits of podcasts are that they are cheap to produce – a computer with the right software and a decent microphone are all that is needed, they are compatible with all MP3 players, and given the right equipment, users have the option of publicly responding to what they hear by posting their own responses on the internet.

In a museum context, Podcasting could be used effectively, especially regarding web-based collections and exhibitions. Given that it does not involve high costs, it could be trialed with a minimum of risk. For example, the museum could link some podcasts about certain key objects in the museum to the museum's website and somehow gauge the popularity from there. This would mean that there would also be no cost to the museum for MP3 players, as at this stage users would use their own.

Obviously this approach relies on people owning and using MP3 players and also being familiar enough with Podcasting to use them. However, the ever-increasing popularity, accessibility and use of MP3 players would make it worthwhile investigating the use of Podcasting for museum purposes. The Museum of Modern Art in New York has already begun to utilize this form of technology in its Art Radio station called WPS1 (<http://www.wps1.org/>), which allows users to listen to or download content from their 24-hour Internet-only radio station. Marymount Manhattan College has also developed unofficial audio guides for MoMA which rely on Podcasting. Instead of being 'guides', they are 'soundtracks for the art' (David Gilbert, Professor of Communication at Marymount Manhattan College). They are also meant to be interactive, with users invited to record their own audio

guides which the Marymount team then posts on the internet for other to access.

In Australia, radio stations such as ABC and 2Dayfm are using Podcasting as a way to expand their audiences. Listeners can download whole radio programs or program highlights to listen to whenever they want.

4.2 *m-ToGuide (Mobile Tourist Guide)*

This is a Europe-wide trial of 2.5G and 3G wireless applications for tourists all over Europe, sponsored by the Information Society Technologies Fifth Framework Program of the European Commission. It is location-based technology which gives users information about nearby historical sites, accommodation and restaurants for example. This information consists of audio, video and text and is delivered via existing mobile phone networks (GSM/GPRS) and the Internet to PDAs such as the Compaq iPaq Pocket PC.

There is a similar Dutch program called *ZaPPWeRK – Culture around the Corner*. It is basically the same as m-ToGuide but on a smaller scale of one country and only provides information about cultural locations. Users can access information via mobile phone, PDA or laptop, which is sent via text message. The goal of this program is to create a database of Dutch cultural locations.

Museums could make use of this type of technology mostly in terms of advertising and bringing visitors into the museum; it is another means of communicating where the museum is and what is on at the museum at that particular time.

5. Observations

A noticeable pattern was the fact that it seems to be the art museums which have taken the lead in using and trialing these types of technology. Perhaps the wider museum sector is catching up though, given the number of institutions which are either trialing or using new forms of mobile and handheld technology now (see http://snse.lsc.org/resources/ASTC_RAP/projectsOverview/RAP_ProjectsOverview.xls, reproduced as Attachment 1). It does look as though this technology is useful in art museums, even though there have been some problems with it. There are fewer evaluations that have been completed on trials in museums, as these trials are mostly still being completed.

Museums must take great care to ensure that if they are going to trial or begin a handheld program, that the needs of the museum and particular exhibitions are addressed and focused on, rather than being too focused on the technology. It is important to choose the

right style of handheld or mobile technology suitable for the museum's needs, so as to augment visitors' experiences of the museum rather than distract them from the exhibits or artworks. It may even be the case that a handheld program is not necessary in some institutions. Museums have to clearly define their own elearning (definitions outlined in section 6) needs and aims before embarking on lengthy and costly trials.

Another consideration is that almost all handheld trials have received some kind of sponsorship or funding from government or private enterprise looking to promote their equipment. It seems to be the only way that museums and galleries can manage to do the trials. Whether it is worthwhile implementing a handheld system when the technology may become outdated has to be considered, although current PDAs and servers are able to support a satisfactory degree of content.

6. E-Learning: some definitions

**ELearning is instructional content delivered over the Internet.*
www.readygo.com/ebus/def02/07def02.htm

**ELearning is a means of implementing education that can be applied within varying education models (for example, face to face or distance education) and educational philosophies (for example behaviourism and constructivism).*
www.ifets.ieee.org/periodical/6-2/1.html

**So far, in most institutions, elearning is a "special project" that requires extra funding - it is not (yet) a cost saver.*
www.elearnspace.org/Articles/Week1_Elearningvs.Classrooms.htm

**E-learning is defined as "...the process through which learning or education is conducted using a computer network, such as the Internet."*
Australian Museum Audience Research Centre. 2003. *Aboriginal Heritage Unit 2003 Workshop Evaluation*. Unpublished report. Sydney: Australian Museum

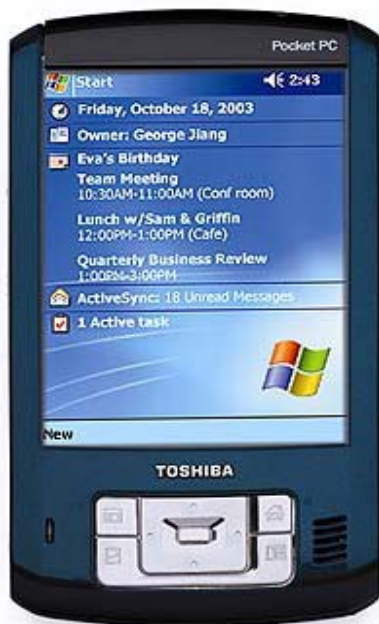
**ELearning is the use of digital media such as the Internet, CDs, Cable TV and streaming media to facilitate education, workplace training, communication and collaboration.*
www.gazel.ws/

The last definition here seems to be the most suited to what museums would be trying to accomplish in implementing handheld programs. The primary aim of a handheld program has to be to engage the visitor whilst they are in the museum and to keep them thinking when they walk out the doors. Museums must decide whether to limit their elearning strategy to the museum building itself, or to provide the

visitor with the opportunity to keep on learning and engaging with material when they get home. This is now possible given the capabilities of current PDAs which can send information to visitors via email. If this is successful, it could translate into higher visitor numbers, as it would be continued contact with the museum.

7. What technology has been trialed?

7.1 Toshiba e750 and e800: PDA used in Tate Modern trials and Blanton iTour. The e800 (below) was released in 2003 and it was found to be sturdy and quite stable for the content it was supporting. The central server at Tate Modern was a Toshiba Magnia 300 series. e800s retail for around \$1200 each and come in WiFi and Bluetooth versions. (www.isd.toshiba.com.au)



ConfigFree (on WiFi model) Easy configurations for your 802.11b wireless environment. Save multiple profiles to suit your required locations eg corporate network, hotspots, home wireless environment. Also includes a handy wireless access point locator.

Acuvie View your Word, Excel and Powerpoint documents in VGA mode - get 4 times the information on your e800 screen.

VoIP (on WiFi model) Enables cheap local and international calls over a wireless network.

BlueTooth Connectivity Whether using the integrated BT on the e800, or the optional SD BT card, the Toshiba BT management software and wizards makes personal wireless connectivity easy for even the novice user.

4" Screen The e800 boasts the largest PDA screen currently on the market. And the even brighter screen offers excellent viewing whether indoors or outdoors.

Integrated SD & CF Slots Maximum expansion capability with no need for cumbersome sleeves.

72 Hour Data Protection 72 hours data protection even after the battery runs flat (180 hours with the high capacity battery).

Auto Backup Schedule automated backups on a daily or weekly basis.

32Mb NAND Data stored in the NAND memory is stored safely, even if the battery runs flat.

USB Host Cable Option Connect to any Pocket PC USB friendly device such as keyboards, printers, mice, storage devices etc

7.2 Compaq/Hewlett Packard iPAQ Pocket PC 3670 (below): One of the PDAs used in Blanton iTour. Found to be very easy to use. It retails at around \$700 per unit.

(www.welcome.hp.com/country/au/en/welcome.html)



- **Operating System:**
 - Windows Mobile 2003 Second Edition Software for Pocket PC
- **Integrated Wireless:**
 - Integrated WLAN 802.11b
 - Integrated Bluetooth
 - IrDA
 - USB
- **Processor:**
 - Samsung S3C 2440 processor
- **Display:**
 - 3.5" (89mm) Transflective TFT colour
 - Portrait and landscape modes
 - 65k colours
- **Photosmart Camera:**
 - Built-in 1.2MP camera
 - 1280 x 960 resolution
 - 4x digital zoom
- **Dimensions:**
 - 114.3 x 71.2 x 16.3mm
- **Expansion:**
 - Integrated SD slot
 - Supports SD/MMC memory cards and 4-bit SDIO cards
 - SDIO Now! driver included
- **Audio:**
 - Integrated microphone
 - Speaker
 - One 3.5mm stereo headphone jack
 - MP3 stereo through headphone jack

7.3 Dell Axim X50: PDA used in Blanton iTour; also found to be easy to use. Retails from \$549-\$722.

(http://www1.ap.dell.com/content/products/productdetails.aspx/axim_x50_416_au?c=au&l=en&s=dhs&~f=lg#tabtop)



- Microsoft® Windows Mobile™ 2003 Second Edition operating system with Windows Media Player 10 Mobile
- Powered by the Intel® XScale™ PXA270 Processor at 416MHz
- Brilliant 3.5" color TFT display
- Integrated Bluetooth™ Wireless Technology
- Packed with 64MB SDRAM and 64MB Intel StrataFlash® ROM
- Integrated CompactFlash Type II and Secure Digital / SDIO Now! / MMC card slots provide flexible expansion
- Removable Primary Battery with optional High Capacity Battery
- 3.5mm Headphone / Headset Jack for Headsets to support voice recognition applications
- Built-in microphone and speaker for easy recording

8. Current projects at the Australian Museum

At present, the Australian Museum is involved in a joint project with the Research Centre on Computer-supported learning and cognition (CoCo) at the University of Sydney entitled '*Using mobile ICT to support sustained student inquiry in e-learning environments beyond the classroom*'. The aim is to take mobile technology such as handhelds, outside the classroom and into the local environment so that students can learn about their environment and collect useful information about it. In particular, 'learning outcomes from student

interaction with the e-learning environment will be monitored and evaluated by the project to assess the effectiveness of the technology to enhance learner experiences in science-based student enquiry' (Peter Reimann, Professor of Education, University of Sydney). The pilot stage of the project should start in August 2005.

The ARC is also part of the Digital Narratives research project with QUT exploring the new forms of literacy that are required to use the digital cultural communication system. 'The project will survey "new literacy" in "digital storytelling" and "experience learning" across a spectrum of sites from community services to national institutions' (Project Summary, QUT ARC Linkage-Projects Incentive Scheme).

9. Conclusions

Handheld devices seem to have great potential to improve visitor experience in museums. As yet however, this potential has perhaps not been fully realized. Trials are still continuing, and the majority of these have been in Europe and the United States. It does not seem that there have been many institutions in Australia that have attempted to adopt an in-depth handheld program. Given that the use of handhelds is becoming widespread, particularly among young people aged from around 10 years, the Australian Museum needs to consider now whether to go along this path. If the Australian Museum were to do so, it would need to carefully consider the following:

- >Target audience, including younger audiences (10-30yrs) and disabled audiences
- >Which exhibits on which to focus
- >Cost
- >Whether there is sponsorship available or whether partnerships with businesses can be developed
- >User-friendliness of technology for both visitors and museum staff so content can be easily updated
- >How long the program will run for until it is updated; this may effect how much is spent on developing it
- >Whether it is needed at all; do visitors to this museum expect this sort of thing and can it improve the museums
- >If a handheld program goes ahead, what infrastructure needs to be included in the building works? Development of a technology strategy to feed into the Renewal Project might be a good start to move this along.

The Australian Museum's revised Purpose Statement (The Australian Museum Corporate Strategic Plan 2005-2008) is 'to inspire the exploration of nature and cultures', and a robust program using

handhelds would be a way of helping to fulfill this purpose. Handheld technology means not only can visitors be engaged at a higher level with the collections, but also that visitors do not have to stop exploring the museum and things that interest them the moment they leave the museum. A great handheld program would also help in achieving Goal 5 of the museum which states that the museum aims 'to capture the imagination of young, old and all those in between'; a handheld program might particularly help to ensure that the 'audience's information, learning and leisure needs are accommodated within a reciprocal life-long relationship'.

Attachment 1

See overleaf the [PDA project table.xls](http://snse.lsc.org/resources/ASTC_RAP/projectsOverview/RAP_ProjectsOverview.xls) (slightly modified) from http://snse.lsc.org/resources/ASTC_RAP/projectsOverview/RAP_ProjectsOverview.xls

Report by Ellen Reynolds, Museum Studies Intern, with input from Lynda Kelly, Head AMARC, 8 July 2005