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The Working Paper Series

WaterSmart Pastoral Production™ Project Literature Reviews

Telemetry systems for remote water
monitoring control equipment

David de Vries

Working Paper

17

2008

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Abstract

Telemetry provides the opportunity for pastoralists to monitor the water supply, animal health, machinery and security of their properties while dramatically reducing travel time and cost.

Two small South Australian companies with a wealth of field experience were identified. Contact Communications and Stockman Electronics produce telemetry equipment that met the criteria of reliability, client endorsement and capacity to withstand harsh conditions,. Three other companies are also installing systems in limited numbers. Costs fall in the range \$1000–2500 per site monitored.

The immediate future of pastoral telemetry appears to be dependent on the success of the different companies involved in successfully marketing themselves and gaining the trust of pastoralists. Telemetry installers are small local enterprises that develop good relationships with their clients. These companies have good products but currently lack the capacity/orientation to market themselves further afield. Observant telemetry equipment is an industry specific product being marketed nationally but it has yet to gain market acceptance. Should a Telstra sponsored product go into commercial production we may anticipate professional marketing of their product.

Several systems reviewed rely on the mobile phone network and are thus currently of limited use in much of the pastoral lands.

Electronics technology is obviously a rapidly evolving field that may bring new and more economical options. Also, the variables of sustainable land management, food health standards and fuel prices may generate the demand for more extensive and more sophisticated telemetry equipment on pastoral properties.

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1. Introduction

The Centre for Sustainable Arid Towns (CSAT) has undertaken the following review for the Desert Knowledge Cooperative Research Centre as part of a project that reviews and disseminates information about better ways of managing precious water resources on pastoral properties in arid and semi-arid rangelands.

This review assesses the availability and use of telemetry equipment for remote water monitoring and control, and identifies both economic and environmental outcomes associated with improved water management as a result of using such equipment for pastoral applications.

This review has focused on the following points of interest:

- existing, commercially available telemetry systems for remote monitoring and control of equipment
- the suitability of available systems for pastoral applications in arid and semi-arid rangelands
- an estimate of the number of users of the systems in rangelands and some first hand testimonials with users
- an assessment of the priority future research and development requirements for remote water monitoring control equipment, as described by end users, manufacturers, suppliers, and key research personnel in the field of remote telemetry.

Telemetry is the term used to describe the logging or reading of information at one site (usually called an outstation) and conveying the information via radio signals to a location remote from the first site (usually called the base station). In turn, signals may be sent from the second remote location to the first in order to activate a device e.g. a pump, valve or camera. The application focus for this review is in monitoring and controlling water supply to remote stock water points on arid and semi-arid pastoral lands.

Photovoltaic solar power is useful for remote sites and is the primary option for power on all the systems described.

2. Commercial systems in use in Australia

This review has identified five installers of telemetry equipment for specific application by the arid/semi arid pastoral industry (see Appendix 1 for all contact details). Several installers use radio equipment from GME Electrophone. GME supply telemetry systems, while their agents modify the systems for their specific use in the field. For a technical description of the basic unit see Appendix 2.

GME makes no claims to being anything other than a telecommunication hardware company. Detectors and controllers specific to the pastoral industry require knowledge by the installer. Unfortunately, there are few companies with this experience.

2.1 Stockman Electronics

Equipment from Stockman Electronics features a GME system combined with hardware developed and built in-house for specific applications. The equipment costs \$2000–2500 per site monitored and Stockman needs to install it.

Tim Stockman is an agent for both GME and Observant systems, and was able to offer valuable insight into the benefits and limitations of both systems (see interview in Appendix 3).

Tim was able to give a contact to the Kidman group of stations in SA who have numerous sites monitored. Paul Jonas, Manager, Quinyambie Station reports satisfaction and no faults with a system combining GME and Stockman's hardware and has plans to extend the network (see interview in Appendix 3).

Stockman stated that GME uses cell call long distance that is compatible with CB networks often already installed on stations. GME has slow data transfer so only limited information can be conveyed. However this

is not a problem for pastoralists who only want coarse data (e.g. is a tank full or less than half full) and do not need results to 1% accuracy.

2.2 Farm and Business Communications

Alex Woolford has designed and built most of the equipment. It is installed across large arid/semi arid pastoral properties in SA. Eight or nine customers have had tank monitoring and pump controlling systems developed over the last two years.

The largest client is Williams Cattle Company (see Interview in Appendix 3) who are expanding from 30 to 45 sites installed at a cost of \$1600–1700 per site. Part-owner Wayne Williams stated that he would not go without telemetry equipment. There are savings in the frequency of bore runs, time travelled and the need for backup storage (tanks) at each bore site. Pumps can be run in the cool of evening and peace of mind is possible. He now checks sites weekly for maintenance on pumps and clearing troughs.

2.3 Contact Communications Pty Ltd

This company installs telemetry equipment based on GME Electrophone radio equipment coupled with detectors and controllers from other suppliers, especially Toro irrigation equipment (www.toro.com.au).

One installation at Bonview Station, Wilcannia, NSW is for arid stock points. It features six sites and repeaters over distances up to 42 km at a cost of \$1000–\$1600 per site.

2.4 Solar Pumping Solutions

Several CDMA (mobile phone) telemetry systems for measuring tank levels and controlling pumps have been installed by this company on properties in central and western NSW. There is an option for using an SMS message as an alert e.g. tank low. The cost is a little over \$1000 for a basic system plus \$5/mo for the message service.

Mobile phone networks are obviously limited in much of the pastoral lands.

2.5 Observant

Observant produces packages combining telemetry equipment and a range of application specific add-ons for farms and pastoralists. They are solely oriented to servicing the farm and pastoral market.

Observant is a new company which began sales activity in June 2006 and has less than 10 installed customers to date, located in the NT, WA and Qld. It is rapidly expanding its network and has resellers in central Queensland, Alice Springs, the Kimberly, the Gascoyne, central SA and southern NSW.

Observant provided the following general information about its telemetry equipment:

- UHF is the most appropriate technology for the majority of pastoral customers, as it is low cost, long range, robust and incurs no per-packet charges.
- UHF line-of-sight range is 25 km, however with careful radio path planning and proper antenna selection this can be increased. Observant has also tested runs over 40km.
- The system is capable of taking still images of varying size and resolution on demand or on a pre-defined schedule.
- Pricing is dependent on what equipment is interfaced with and installation requirements, but a basic water point monitoring solution starts at \$2500 and the base station and software required to monitor the entire system (regardless of how many water points are being monitored) is \$1195.

Observant is currently testing a 900MHz option and investigating satellite, GSM (Global System for Mobile communications) and GPRS (General Packet Radio Service) technology to extend the range.

For detailed technical specifications see Appendix 2.

Agents and users

Tim Stockman, (see interview in appendix 3) is an agent for both GSM and Observant systems, and was able to offer valuable insight into the benefits and limitations of both systems.

His comments about Observant are summarised below:

- Observant provides more detailed information than GSM including capacity for images.
- Observant has been working closely with industry and therefore has potential to produce easily installed equipment.
- The systems require repeaters every 25 km and are therefore expensive for systems operating over large distances such as pastoral properties with stock water points.
- The Observant UHF signal cannot be legally moved to CB.

Tim Stockman has also made recommendations for modifications required to suit conditions in SA, including modifications to avoid corellas damaging telemetry equipment.

Tim Stockman stated that he plans to install Observant systems for around \$2500–\$3000 per site.

CSAT was only able to identify one user of Observant telemetry systems in the arid and semi-arid rangelands, and this is a development and demonstration site for the company at Pigeon Hole Station in the NT.

Steven Cadzow at “Mt. Riddock” station via Alice Springs is interested in an Observant telemetry system for monitoring water tank levels (see interview in Appendix 3).

3. Systems in development in Australia and overseas

Brendan Doyle of the University of New England (UNE) (see interview in Appendix 3) is working with Telstra on a camera/CDMA system. The major features of this system are detailed in Appendix 2.

Brendan stated that farmers have commented on the versatility of this camera/CDMA system. One of the systems is currently being tested for monitoring brumbies in a national park. This system is not near a region that has a CDMA network and is using high gain aerials and repeaters. UNE and Telstra are also planning trials in Walgett and Lightning Ridge.

Telstra is currently developing a costing model for this system. One model is expected to have an up-front cost of \$200–400, with an ongoing charge of \$60 a month for the phone line service. After two years, this system would be paid off, and the only ongoing cost will be for data. Telstra is also looking at satellite solutions that could extend the range.

Telstra claims to be actively developing farm systems at www.telemetry.trl.oz.au. However, no response to a request for specific information was forthcoming.

In related research CSIRO Livestock Industries in Queensland has been testing a telemetry recorder mounted on cattle that records location of the animals using GPS, as well as body temperature. The stored data is downloaded at muster to give information on grazing patterns. For more information see the interview with Ed Charmley in Appendix 3 and www.csiro.au/csiro/content/standard/pstv_..html

Two overseas companies that manufactured and supplied telemetry equipment for pastoral application were identified. Contact details for these companies are listed in Appendix 1 and general information about the systems they produce is summarised below.

Virtual Technologies Ltd, in Michigan, produces a system called Virtu-Well that allows wireless monitoring of pumps, tank levels, and water flow and can send alarms via digital pager and email within five minutes of

an event. Internet access is used to monitor, update and control Virtu-Well systems. The systems are for tanks up to 30" deep and heavy duty versions that are livestock and freeze resistant are available. Further details are available on their website at <http://www.virtualtechnologiesltd.com>

BayCity Technologies Ltd, in New Zealand, is focused on telecommunications and telemetry systems for farmers based on the mobile phone network. They plan to expand into Australia in 2007 (see www.baycity-technologies.com).

4. Conclusions and future

Several companies have successfully installed telemetry equipment that provides simple data and control over remote equipment in arid conditions. Significant labour and expense savings are apparent on large properties. Users seem satisfied with performance and local developers are able to devise specific solutions as new applications or novel environments are identified.

Image transmitting systems such as Observant are more sophisticated and would have a value where visual or more detailed information is required. Where a property already has CB radio infrastructure a strong argument exists for using the simpler systems. Observant systems are only new to the Australian market and have little, if any, take-up,

The immediate future of pastoral telemetry appears to be dependent on the success of the different companies involved in successfully marketing themselves and gaining the trust of pastoralists. Telemetry installers are small, local enterprises that develop good relationships with their clients. These companies have good products but currently lack the capacity or orientation to market themselves further afield. Observant is being marketed nationally but has yet to gain market acceptance. Should a Telstra sponsored product go into commercial production we may anticipate professional marketing of their product.

This reviewer concludes that lack of research is not a problem as developments by private industry have provided useful products. The next technological challenge involves transmitting more data (images) over longer distances (200 km) in a cost effective manner. To some extent, private industry is working to address this challenge. Moreover, this issue can be avoided by using the current, low data rate systems. The market demand/need for information intensive systems remains undetermined.

Electronics technology is obviously a rapidly evolving field that may bring new and more economical options. Also, the variables of sustainable land management, food health standards and fuel prices may generate the demand for more extensive and more sophisticated telemetry equipment on pastoral properties.

Appendix 1 – Contact details

BayCity Technologies Ltd

Solon Payne, Director, Business Development

PO Box 1497 Christchurch Mail Centre Christchurch 8011 New Zealand

Ph: 64 3 366 9936

solon.payne@baycity-technologies.com; www.baycity-technologies.com

Contact Communications Pty Ltd

Michael Constable

Shop 2/5 Murray St Gawler SA 5118

Ph: (08) 8522 5558; contact@bigpond.net.au

Farm and Business Communications

Alex Woolford

49 Stephens St Booleroo Centre SA 5482

Ph: (08) 8667 2268 Fax: (08) 8667 2269 Mob: 0427 619 594

fbcom@ozemail.com.au; www.fbc.bizhosting.com

GME Electrophone

Robert Glover

Sydney Sales Office: Unit B 22–24 College Street Gladesville NSW 2111

Ph: (02) 9879 8888 Fax: (02) 9816 4722

www.gme.net.au/commercial/telemetry/telemetry_info.php

Observant

J. Matthew Pryor

Level 2 106 Victoria St Fitzroy Vic 3065

Ph: 1 300 224 688

jmp@observant.com.au; www.observant.com.au

Solar Pumping Solutions

Steve Harding

"Hillcrest" 7433 Castlereagh Hwy Ilford (via Mudgee) NSW 2850

Ph: 61 2 6358 8443 Fax: 61 2 6358 8612 Mob: 0427 240 294

info@solarpumping.com.au; www.solarpumping.com.au

Stockman Electronics

Tim Stockman

3 Young St Burra SA 5417

Ph: (08) 8892 2708 Fax: (08) 8892 2788

sales@stockmanelectronics.com.au; www.telemetry.stockmanelectronics.com.au

Virtual Technologies, Ltd

2050 Pebble Creek Drive Oakland Michigan USA 48363

Ph: 1 509 990 3919

<http://www.virtualtechnologiesltd.com>

Appendix 2 – Technical details

GME Electrophone

Technical background from: www.gme.net.au/commercial/telemetry/telemetry_info.php.

Protocol: The GME telemetry system uses a standard 10 tone selective calling protocol (CCIR) with a proprietary packet structure for data transmission. This method is simple and robust, delivering greater range and superior error-free transmission when using lower data rates, than is normally achieved with conventional digital systems.

The transmitted signal contains the address ID of the station being called and the input/output ports being addressed, as well as the command or request message being sent or received. The outstation repeats the message back to the base station to confirm it has been correctly received.

The base station can be pre-programmed to retransmit the message a given number of times until the outstation confirmation reply is received. If no reply or an invalid response is received, an appropriate warning message is sent to the user.

Transmission: GMEs telemetry system operates in the popular 450–520 MHz UHF band. This means that if the path between the base station and an outstation can achieve a reliable signal level, ranges of up to 100 km can be attained. However, if the path is blocked by the topography of the land or to a lesser extent by trees, the range can be reduced to several kilometres.

To overcome these problems, your dealer can use a PC to reconfigure a TX3600T to serve as a 'Store and Forward' Repeater. This arrangement allows the operational range of the system to be extended.

Over long distances or difficult terrain, the TX3600Ts full 5 watt output power will maintain a reliable radio link. For shorter distances a selectable 1 watt output power option is available.

Installations: The following examples are typical applications for the GME telemetry system:

- Switching pumps or irrigation systems on and off
- Starting generators and monitoring temperature, pressure or voltage
- Monitoring dam and tank levels
- Real time monitoring of security devices with an instant alarm if a break-in occurs
- Monitoring and controlling the operation of electric fences
- Remote reading of instruments such as weather and water flow gauges

Monitoring the status of gates at remote locations.

Farm and Business Communications

Technical specifications:

Water monitoring: Builds own system with control boxes, antenna, and photovoltaic cells. Mounts onto top of water tank with detector descending into water. Detector is triggered by capacitors inside PVC pipe (1 ft resolution). Takes one hour to install himself. Signals sent from any radio using attached box (also self manufactured) cell call via DTMF (Dual-Tone Multi-Frequency). Report comes back from sensor as voice (e.g. north tank 6 feet).

Pump controller: uses similar system. From website: Operation of starter solenoid, glow plugs, fuel circuits, and generator circuits, can all be controlled during startup and close down using the control unit. All functions of startup and timing can be preprogrammed simply.

The length of time that the diesel will run can also be set via radio. Operation of the engine can be monitored using inputs on the control unit, and any failure can be used to close the engine down and send a Selcall alarm signal to the base radio (homestead). It is also possible to listen to the engine running.

The control and activation of the engine site is achieved using DTMF tone sequences transmitted over radio. Security is maintained by the need to send a unique code to each engine site to allow its operation. The reception of commands is confirmed by reply tones or optional voice confirmation.

The equipment is designed to interface with most UHF CB or commercial radio products with no need to modify the radio. Connection is simply made to the microphone input and extension speaker socket.

Programming of the engine control unit can be done on site, using a DTMF programmer, or over air using the homestead control unit.

Farm and Business Communications manufacture a simple to operate homestead based control unit for simple activation of all out-sites. Three or four key strokes are required for the operation of up to 99 sites.

Observant

Observant system specifications

Communications

- 5W UHF radio 450–490 MHz (nominally tuned to UHF channel 22)
- conservatively 25 km line-of-sight range
- 4800 band GMSK modem
- All units capable of acting as repeaters (to extend range or route around terrain).

Connections

- 2 x general purpose 9-pin ports
- antenna (BNC connector)
- 2-pin power connector.

General purpose ports. All pins are protected against shorts, reverse polarity and voltage transients. Each port provides:

- 2 x digital outputs (can supply up to 1.0 A continuous)
- 2 x digital inputs (can frequency count up to 1 kHz)
- RS232
- RS485.

Devices supported. Device driver architecture allows for easy addition of support for new sensors. Drivers at or near nearing completion include:

- L1 Observant's level sensor (available in length multiples of 400mm; typically 400mm for troughs, and 2000mm for dams/tanks, with a resolution of 10mm)
- M1 Observant's motor controller (allows remote start/stop and monitoring; engine watchdog: monitors temperature, oil pressure, rpm, flow, etc; engine start warning siren, battery monitoring and integrated solar charger)
- MonoSMC solar pump
- Pakton electric fence monitor
- Axis digital camera
- PFSA Nutridose water medicator
- Rain gauge, flow meter
- Generic input and output
- GPS vehicle tracking.

Regular maintenance

- Battery replacement required every 24 months (\$20 battery, takes 5 minutes to install)

Camera CDMA system

Major features:

- in development phase by University of New England and Telstra
- Camera with input and output
- Using a CDMA modem in current trials but plan to switch in 2007 to Maxon 3G modem because it has more bandwidth with similar coverage
- Streaming stills: 2–4 per sec
- Solar powered with 60–80W panel
- Options: night camera, fill-time or level on water trough, alarm for vehicles approaching, monitoring electric fences
- Maxon modem, RFI transmitters
- Monitor system from remote computer anywhere
- Provides security
- Can send SMS texts when approached by vehicle (although sometimes these SMS messages are delayed)
- Ventilated and cooled camera should work anywhere
- Produced with standard components in UNE Physics Department.

Appendix 3 – Interview records

Question or topic	Response
Name and contact:	Steven Cadzow “Mt. Riddock” via Alice Springs Ph: (08) 8956 9963
Role in industry:	Pastoralist
Manufacturers:	Observant; waiting to hear back from them on specific application.
Product specifications:	UHF.
Ease of use, maintenance requirements:	
Known limitations and or faults:	
Used by the pastoral industry for stock water points?	Only example at Pigeonhole (property linked to Observant company).
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	Interested in a system for controlling electric start/stop of water pump for maintaining level on water tank. Water tank then supplies trough on float. Telemetry system conveys signal from bore pump to tank as well as from tank to home. Useful to know if pump is less than half full and therefore a problem. Also interested in camera capacity although “very slow” to get image.
Capacity to deal with need (is it what pastoralists really want?):	
Access to backup support:	
Cost:	\$2000 for Observant system is affordable.
Number of users of the systems in rangelands:	No others.
Duration of use:	
Perceived benefit:	
Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	Bores all switching to solar pumping in future. Need to be compatible.

Question or topic	Response
Name and contact:	Dr Ed Charmley CSIRO Livestock Industries, Rockhampton, Qld Ph: (07) 4923 8174 ed.charmley@csiro.au .
Role in industry:	Research
Manufacturers:	Blue-Sky made in Scotland.
Product specifications:	Telemetry recorder mounted on cattle. Records location (GPS) and temperature. Data is downloaded at muster to give information on grazing patterns.
Ease of use, maintenance requirements:	Lot of maintenance/repairs; repairs and maintenance required after every deployment. Only 3-4 deployments per unit.
Known limitations and or faults:	Difficult to source batteries that can withstand temperatures on range. Problems in data acquisition in wet season/overcast.
Used by the pastoral industry for stock water points?	No. Thinks there may be some systems that relay information directly?
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	Demonstrated in Charters Towers and Rockhampton areas.
Capacity to deal with need (is it what pastoralists really want?):	Research into grazing only.
Access to backup support:	Problem with offshore company.
Cost:	\$3000 per collar/recorder.
Number of users of the systems in rangelands:	
Duration of use:	
Perceived benefit:	
Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	

Question or topic	Response
Name and contact:	Michael Constable Contact Communications Pty Ltd Shop 2/5 Murray St Gawler 5118 Ph: (08) 8522 5558
Role in industry:	Manufacturer and installer.
Manufacturers:	
Product specifications:	GME electrophone radio equipment coupled with other suppliers detectors and controllers especially Toro irrigation equipment (www.toro.com.au).
Ease of use, maintenance requirements:	
Known limitations and or faults:	Limited data rate.
Used by the pastoral industry for stock water points?	One installation at Bonview Station, Wilcannia, NSW is for arid stock points; features six sites and repeater over distances up to 42 km. Includes pipe flow monitoring and control (24 km polypipe line!). Other agricultural installations.
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	
Capacity to deal with need (is it what pastoralists really want?):	
Access to backup support:	
Cost:	\$1000–1600 per site.
Number of users of the systems in rangelands:	One.
Duration of use:	
Perceived benefit:	
Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	

Question or topic	Response
Name and contact:	Delphine Bentley R&D Officer North Australian Pastoral Company Ph: (07) 3221 2266, dbentley@napco.com.au
Role in industry:	Research.
Manufacturers:	
Product specifications:	
Ease of use, maintenance requirements:	
Known limitations and or faults:	
Used by the pastoral industry for stock water points?	NAPCO has 6.5 m ha in Qld and NT mainly in Channel Country and Barkley Tablelands; no telemetry in use.
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	
Capacity to deal with need (is it what pastoralists really want?):	
Access to backup support:	
Cost:	
Number of users of the systems in rangelands:	
Duration of use:	
Perceived benefit:	
Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	Planning a project with WaterSmart Rangelands Qld (NRM) to investigate different telemetry systems at Monkira (373 000 ha on the Diamantina River 130 km east of Bedourie in Qld Channel Country . Contact Colleen James, WaterSmart Project Officer, Longreach.Ph: (07) 4658 0600, colleenj@dcq.org.au

Question or topic	Response
Name and contact:	Brendan Doyle Research Economist University of New England, Armidale, NSW 2351 Ph: 02 6773 3077 Fax: 02 6773 3245, Mob: 0428 597 113 Brendan.Doyle@une.edu.au Assistant Director, Institute for Rural Futures http://www.ruralfutures.une.edu.au Program Leader, Cotton Catchment Communities CRC http://www.cotton.crc.org.au
Role in industry:	Researching remote telemetry applications for agriculture.
Manufacturers:	Produced with standard components in UNE Physics Department.
Product specifications:	Telemetry camera with input and output, CDMA modem now (next year switch to Maxon 3G modem - more bandwidth, similar coverage), streaming stills 2–4 per sec, solar powered with 60–80W panel. Options – night camera, fill-time or level on water trough, alarm for vehicles approaching, monitor electric fence. Maxon modem, RFI transmitters.
Ease of use, maintenance requirements:	“Plug and play” stand alone solar.
Known limitations and or faults:	6–8 days cloudy weather on battery. CDMA coverage. One system in place monitoring brumbies in a national park far from CDMA area using high gain aerials and repeaters.
Used by the pastoral industry for stock water points?	Anticipated. Additional security function is valued.
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	Planning trials in Walgett and Lightning Ridge; ventilated and cooled camera - should work anywhere. In September 20 units deployed on farms throughout NSW, Vic on cost recovery basis and no data charges. Data collected for 5–6 mo and users interviewed about outcomes and difference in life.
Capacity to deal with need (is it what pastoralists really want?):	agQuip demonstration days have provided useful feedback.
Access to backup support:	
Cost:	Costing model still being developed with Telstra. One model would have a unit having an up-front cost of \$200–400 then \$60/mo for service. After 24 mo, system is paid off and then on-going cost for data.

Number of users of the systems in rangelands:	Users in upcoming trial.
Duration of use:	
Perceived benefit:	Farmers appreciate versatility – observe system from computer anywhere. Provides security. Can send SMS when approached by vehicle (but sometimes SMS messages are delayed).
Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	agQuip demonstration days provide new ideas. Satellite solutions from Telstra could extend range. Also see www.telemetry.trl.oz.au

Question or topic	Response
Name and contact:	Steve Harding Solar Pumping Solutions "Hillcrest" 7433 Castlereagh Hwy, Ilford (via Mudgee) NSW 2850 Ph: (02) 6358 8443, Fax: (02) 6358 8612 Mob: 0427 240 294 info@solarpumping.com.au , www.solarpumping.com.au
Role in industry:	Installer
Manufacturers:	Two telemetry systems: CDMA 'WatchDog' (installed several) and Observant (have not installed any yet).
Product specifications:	CDMA 'WatchDog' tank level monitoring. Gives accurate reading of level and you can interrogate with CDMA phone. Alarm SMS when reaches low level. Optional system to start pump by sending another message.
Ease of use, maintenance requirements:	
Known limitations and or faults:	CDMA coverage.
Used by the pastoral industry for stock water points?	Yes.
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	Yes; system in central and western NSW.
Capacity to deal with need (is it what pastoralists really want?):	Don't want other information and expense.
Access to backup support:	
Cost:	CDMA: a little over \$1000 basic \$5/mo messages; Observant: \$3000 basic.
Number of users of the systems in rangelands:	
Duration of use:	
Perceived benefit:	
Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	

Question or topic	Response
Name and contact:	Paul Jonas Manager, Quinyambie Station (Kidman Group), SA. Ph: (08) 8091 2516.
Role in industry:	Pastoralist
Manufacturers:	Stockman Electronics.
Product specifications:	One system 200 km from base.
Ease of use, maintenance requirements:	No problems or maintenance. Only difficult when CB/UHF system on property plays up.
Known limitations and or faults:	Nil.
Used by the pastoral industry for stock water points?	Yes, primary use.
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	Yes, property in far north east of SA.
Capacity to deal with need (is it what pastoralists really want?):	Good purchase.
Access to backup support:	
Cost:	\$24 000 spent so far on series of systems.
Number of users of the systems in rangelands:	Only know of Kidman users.
Duration of use:	Three years.
Perceived benefit:	Saved \$15 000 in first year. Now only employ one, not two, bore workers, saving one wage and one vehicle cost.
Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	About to install new systems with Stockman Electronics custom designed for a) opening valve to permit air bleed from pipe and b) control valves to pump in different directions.

Question or topic	Response
Name and contact:	Randall Crozier Anna Creek Station Ph (08) 8670 7978
Role in industry:	Station Manager
Manufacturers:	
Product specifications:	
Ease of use, maintenance requirements:	
Known limitations and or faults:	
Used by the pastoral industry for stock water points?	
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	
Capacity to deal with need (is it what pastoralists really want?):	
Access to backup support:	
Cost:	
Number of users of the systems in rangelands:	
Duration of use:	Tank level monitors - we have had these for 2 years, and are planning to put in two more this year.
Perceived benefit:	Huge saving in fuel and 4WD costs, peace of mind, allows other work to be done.
Glitches and problems encountered (e.g. signal reach, failures):	Some distortion at times with signal although most of the time quite OK.
Other features that are desired:	Automatic alarm set to go off when levels are too low or loss of flow to trough.
Priorities for future research and development:	

Question or topic	Response
Name and contact:	Tim Stockman Stockman Electronics 3 Young St, Burra, SA 5417 Ph: (08) 8892 2708, Fax: (08) 8892 2788 sales@stockmanelectronics.com.au www.telemetry.stockmanelectronics.com.au
Role in industry:	Research, manufacturer, supplier, installer and maintainer.
Manufacturers:	GME-Stockman (co-developer) and Observant (reseller) Modify and develop detectors and controllers able to handle field conditions.
Product specifications:	GME-Stockman uses cell call long distance that is compatible with CB network often installed on stations. Solar powered. Observant UHF signal cannot be legally moved to CB. Solar powered.
Ease of use, maintenance requirements:	Low.
Known limitations and or faults:	Requires installation. GME-Stockman has slow data transfer so that limits information. Observant requires repeaters every 25 km. Therefore expensive for distances.
Used by the pastoral industry for stock water points?	Usual application.
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	GME-Stockman employed primarily on large dry properties. Observant using Stockman recommendations on modifications required for conditions in SA e.g. corellas. Very destructive to equipment. Only field application is Pigeon Hole, the developer's own property.
Capacity to deal with need (is it what pastoralists really want?):	Tim sees that he has unique insight into what pastoralists need i.e. not technology for its own sake, but simple interfaces. He has specialized insights into local conditions e.g. reactions caused by salts, bubbles and dissolved reactive gases in water makes water pressure detectors useless. Pastoralists want only coarse data e.g. is tank full or less than half full, but do not need results to 1% accuracy.
Access to backup support:	Confines work to SA to ensure support.
Cost:	GME-Stockman: \$2000–2500 per site; install 6–10 sites per property. Observant: \$2500–3000 per site.
Number of users of the systems in rangelands:	GME-Stockman: 15–20 users. Observant: none installed yet.

Duration of use:	
Perceived benefit:	
Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	Working on modifications that can be installed by pastoralists.

Question or topic	Response
Name and contact:	Wayne Williams Williams Cattle Company (Mount Barry Station, Sarah Station, Hamilton Station), Near Oodnadatta, SA Ph: (08) 8670 7960
Role in industry:	Pastoralist
Manufacturers:	
Product specifications:	Alex Woolford, Farm and Business Communications has installed system. Currently 30 sites expanding to 45. Closest site 67 km to home. Bore run takes 2 days. Formerly, needed to check two or more times per week. Now only once per week to check troughs and service pumps. Remotely check functions once or twice per day. System sends alarm when near empty.
Ease of use, maintenance requirements:	
Known limitations and or faults:	Early models had problem with radio drawing too much power, cockies destroying electrical conduit and water detection being damaged in transit. All quickly remedied by FBC. Since then trouble free. In future need to purchase pumps with start and stop mechanism. Kubota pump lacked stop and FBC had to devise a unique kill mechanism.
Used by the pastoral industry for stock water points?	
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	
Capacity to deal with need (is it what pastoralists really want?):	
Access to backup support:	Personally responds.
Cost:	\$1500 inclusive per site.
Number of users of the systems in rangelands:	
Duration of use:	
Perceived benefit:	Back-up tank/storage capacity no longer required which is a major saving. Can turn pumps on in cool of evening i.e. more efficient. Alex is bloody good at work. Would not go without system. Happy to demonstrate it to others.

Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	

Question or topic	Response
Name and contact:	Alex Woolford Farm and Business Communications 49 Stephens St Booleroo Centre SA 5482 Ph: (08) 8667 2268, Fax: (08) 8667 2269, Mob: 0427 619 594 fbc@ozemail.com.au www.fbc.bizhosting.com
Role in industry:	Manufacturer and installer.
Manufacturers:	
Product specifications:	See Appendix 2.
Ease of use, maintenance requirements:	
Known limitations and or faults:	Has installed one or two point-to-point GME systems but pastoralists report interface too clumsy. Has noted a disadvantage that with telemetry installed less visual inspection may lead to pump failures.
Used by the pastoral industry for stock water points?	Water monitoring demand/business only developed in last 2 years. Williams Cattle Company (near Oodnadatta; (see previous interview) 50 sites. Arkuna Station 10 tanks 4 pumps Andrew Popke Ph: (08) 8673 7402. Jumbuck Pastoral (near Challenger Goldmine) 8 tanks.
Suitability of these systems for arid and semi-arid rangelands pastoral applications, including reliability under harsh conditions:	Proven. Extremely reliable. First few models had problems with birds attacking wires but has since redesigned. Salt deposit on tank probe has caused problems once or twice (south west of Cooper Pedy) but easily cleaned or replaced (value only \$18).
Capacity to deal with need (is it what pastoralists really want?):	
Access to backup support:	Personally responds.
Cost:	\$1600–1700 per site.
Number of users of the systems in rangelands:	8 or 9.
Duration of use:	
Perceived benefit:	
Glitches and problems encountered (e.g. signal reach, failures):	
Other features that are desired:	
Priorities for future research and development:	May get equipment constructed on contract.

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