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Technological Innovation at the Amrun Project 2017



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Abstract

The Amrun Project encompasses the engineering, procurement, and construction management (EPCM) of a range of infrastructure required to support a new bauxite mine on part of Rio Tinto's existing lease, south of the Embley River, between Weipa and Aurukun on the Western Cape York Peninsular, Queensland, Australia. This includes the construction of a bauxite mine, accommodation, processing plant, dam, tailings storage facility, roads, export wharf, and ferry terminals to transport workers from Weipa to the mine. At the request of the local Aboriginal Traditional Owners, the project is known as Amrun—the Wik-Waya name for the area.

Amrun is a tier-one investment opportunity for Rio Tinto, with a planned initial output of 22.8 million tonnes per annum and options to expand up to 50 million tonnes. The Amrun resource will replace production from Rio Tinto Weipa's East Weipa mine and increase annual bauxite exports from Cape York.

Bechtel is the EPCM Contractor for Rio Tinto and is working with capable and experienced design and construction organizations to deliver a world-class facility. The construction period is expected to take three years, with first shipment in H1 2019. The construction workforce will peak in mid-2017.

As part of the delivery of the Amrun Project, Bechtel is delivering or implementing a range of innovative technological programs, including a self-operated drone program, a Virtual Reality tool for community engagement, and a mobile phone application for workforce engagement.

Using modern technology for traditional construction and engagement activities has, and is, proving to be an effective tool on the Amrun Project.

Amrun Drone Program

In late 2016, the Amrun Project worked closely with the Bechtel Future Fund group to develop a proposal for a Drone Program to be implemented in 2017. Initially planned for subcontractor delivery, the Amrun Project client, Rio Tinto, was impressed with the concept and decided to make the Program an owner funded, self-operated, initiative.

The Program, which commenced operations in April 2017, utilizes three different types of Unmanned Aerial Systems (drones) for a number of different purposes, including:

- Construction progress monitoring.
- GIS map production.
- 3D modelling.
- Stockpile estimation.
- Remote observations.
- Visual inspections.
- Hi-res photography and videography.
- Zone management and bush fire monitoring.
- Creek flow monitoring.
- Turtle nests and feral animal monitoring
- HSE/completions inspections of 'hard-to-reach' places/structures.
- Community engagement.

The Amrun Project currently has five trained and qualified pilots operating the drone program, with a view to expand as the program progresses. The pilots were drawn from existing employees who received training on how to operate the drones. This has broadened the Project's workforce skill set, and resulted in cost savings for the Project.

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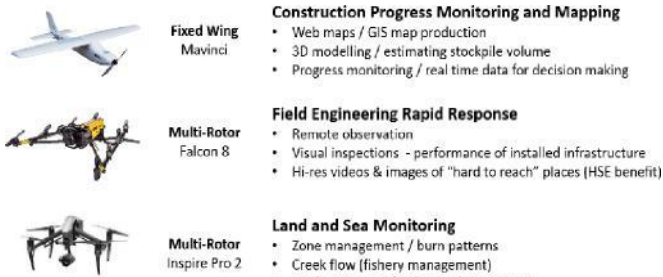


Figure 1. Amrun Project UAS fleet and their functions.

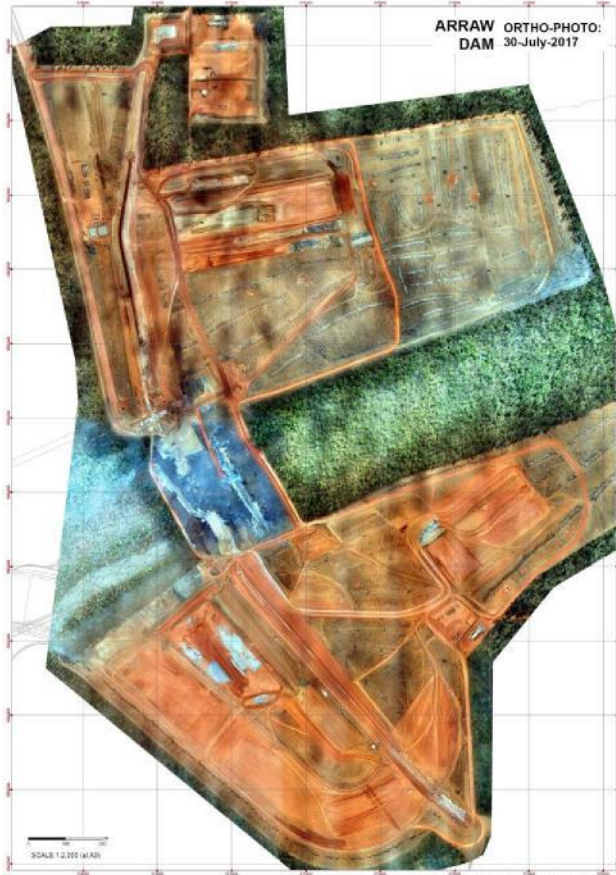


Figure 2: Orthomosaic example using the MAVinci drone.

Below are six examples of how drones have been effectively used on the Amrun Project.

1: Work area surveys

Using drones, rather than people, to survey an area decreases the risk of people being in a work front with machinery. To test this, an area (approximately 30HA) inside the future Tailings Storage Facility was chosen as the test site to assess if drones can be used to validate End of Month Progress claims.

The MAVinci drone was found to be very accurate in surveying works areas and the Project plans to use this drone to survey the remaining clear and grub area in the

800HA Tailings Storage Facility for the duration of the Amrun Project.

2: HSE/Completions inspections

The Amrun Project construction program includes the erection and commissioning of six communications towers, each 70m in height.

For completions inspections (punch list activities), it is impractical to have all necessary parties inspect each tower by EWP or by climbing the tower.

Drones have been effectively used to perform numerous inspection and review tasks on the Project. In one situation, the Falcon 8 (multi-rotor) drone flew eight times around a communications tower, taking 45 photos each time to ensure all angles were captured.

These photos were reviewed and issues were identified that were shared with the contractor. Examples of issues identified (and subsequently rectified) included:

1. Cable support distance on a vertical run not to specification (acceptable distance <900mm).
2. Cable duct not supported. (Support is 2m from the end of the duct).
3. Cables are spliced (No splices allowed without approval).
4. Cable Protection Missing (Unprotected cable tied to steel).
5. Cable not fitted with edge protection where it enters the steel conduit.

The key benefit from this use of the Falcon 8 (multi-rotor) drone was the elimination of high risk working-at-heights activities, and allowing EWPs to be utilized in other work areas.

3: Bushfire monitoring

A scrub fire was discovered near the Project, and the inspire Pro 2 drone was immediately sent to ascertain the location, how fast the fire was travelling, and identify potential risks that a nearby workgroup faced.

4: Photography and videography

The Inspire Pro 2 drone was used to capture images of the arrival of the Project's first Heavy Lift Vessel which was also being filmed by a film crew contracted by the Project.

The drone provided a valuable, additional perspective and the drone footage captured was provided to the film crew for incorporation into the final video. By utilizing the Project's onsite drone operators and subsequent footage, the Project saved money by eliminating the need to bring an external drone operator onsite.

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Figure 3: Aerial image of first Heavy Lift Vessel.

5: Environmental monitoring

An Osprey nest was identified in a tree located in a key area scheduled to be cleared as part of the Tailings Storage Facility development. The discovery of this nest meant that clearing activities had to be stopped and rescheduled until the Osprey chicks had left the nest.

The Falcon 8 (multi-rotor) drone was used to monitor the nest. This enabled work activities to be planned around the Osprey chicks' expected departure from the nest. It also ensured clearing did not recommence until all the chicks had left the nest.

The drone provided very useful and timely information and thereby reduced the risk of clearing too soon, or waiting too long after the chicks had departed the nest, to recommence clearing activities.

6: Community engagement

During a recent cultural heritage camp, hosted by local Aboriginal Traditional Owners, and attended by Amrun Project employees, a drone demonstration was provided using the Falcon 8 (multi-rotor) drone. This drone connects to a Virtual Reality headset that enables the wearer to view what the drone camera is recording.

Senior Traditional Owner, Uncle Tony Kerindun, who is wheelchair bound, was able to view the coastline of his country for the first time in many years.



Figure 4. Senior Traditional Owner, Uncle Tony Kerindun, using the Falcon 8 drone goggles to see the coastline.

Virtual Reality at Amrun

The Amrun Project has introduced a Virtual Reality tool to support Community Relations, Engineering and Design activities, and Workforce Engagement. Commencing development in late 2016, the tool is now in use on the Project, after a brief trial period.

Virtual Reality for Community Relations

The Amrun Project team is actively engaged with the local Aboriginal Traditional Owners – the Wik-Waya people. The Virtual Reality tool has been used to work with the Wik-Waya people, and other community groups to enable them to visualize the future of the Amrun Project and understand the changes that will occur as the Project progresses.



Figure 5. Senior Traditional Owner, Uncle Tony Kerindun, experiencing Virtual Reality for the first time.

Virtual Reality for Engineering

Amrun Engineers have been heavily involved in the development of the Virtual Reality tool, from working with designers, to trialing and sharing the tool with their engineering and design colleagues from around the world.



Figure 6. Virtual Reality image of Chivarri, the Traditional Owner area, in the Amrun Village.

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Figure 7: Amrun Engineer, Scott McLachlan, using the Amrun Virtual Reality tool.

Virtual Reality for Workforce Engagement

The Virtual Reality tool has also been used for recruitment purposes to show local prospective employees what to expect when they arrive on site.

Additionally, Virtual Reality demonstrations have been held in the Amrun Village and at toolbox and job planning sessions to show the workforce the facilities they are helping to construct.

Future state of Virtual Reality

Going forward, the Amrun Project intends to use the Virtual Reality tool to demonstrate long term regeneration growth of different plant species.

The tool has the capacity to map out plant species' locations and estimate their rate of growth. Images can be shown in incremental periods over a number of years. This will support the Project's long term planning and engagement with Traditional Owners by enabling them to visualize how the area is likely to change as plants grow.

myProject Mobile Application

The Amrun Project has received approval from the Future Fund to develop and implement a mobile application (App) for workforce engagement.

Initially proposed in late 2016, the Amrun Project has been working with external developer, Red E App, to deliver this initiative, with roll out expected in Q4 2017.

App purpose and functionality:

The App will be an interactive mobile phone based tool delivered to all Project employees to enable quick and easy access to key Project information.

This will include:

- General Project information,
- Site and Village maps,
- Ferry, bus, and charter flight timetables,

- Diner, gym, and reception hours of operations,
- Gym and events timetables,
- Key contacts,
- Photos and videos,
- Reward and recognition overview and nomination form,
- Surveys, quizzes and crowd sourcing platform,
- Feedback form, and
- Push notifications for Emergency Communications.

The App will be available on all smart phones, Android and Apple, and will be a useful source of information for employees.

Implementation:

The timing for implementation of the App aligns with the timing for the Project to finalize its Site Communications System implementation and aligns with the peak workforce period (Q4 2017).

This initiative has been approved for a 12-month period, and is expected to be rolled out in early Q4 2017. Provision of the App will cease in Q4 2018 when the Project is nearing completion.

App benefits:

The myProject App will:

- Reduce the administrative burden on Supervisors by making basic Project information readily available to employees,
- Be a tool for active engagement and communication by Project Leadership
- Increase pride and participation in a Project by enabling the workforce to share photos/facts with their families,
- Reduce email traffic on Projects by making key information readily available.

The myProject App is an easy to use, easy to roll out communication tool, providing key information and allowing Project Leadership to actively engage with the workforce without message dilution.

Conclusion

By embracing new technology, the Amrun Project has seen many tangible and intangible benefits, including improvements in safety, environmental, schedule, cost, and employee and community engagement and satisfaction.

Utilizing drones to reduce high-risk work activities, monitor the first months of an Osprey chick's life, and engage with Traditional Owners through the use of Virtual Reality, are all examples of the Amrun Project being a pioneer in technological innovation.