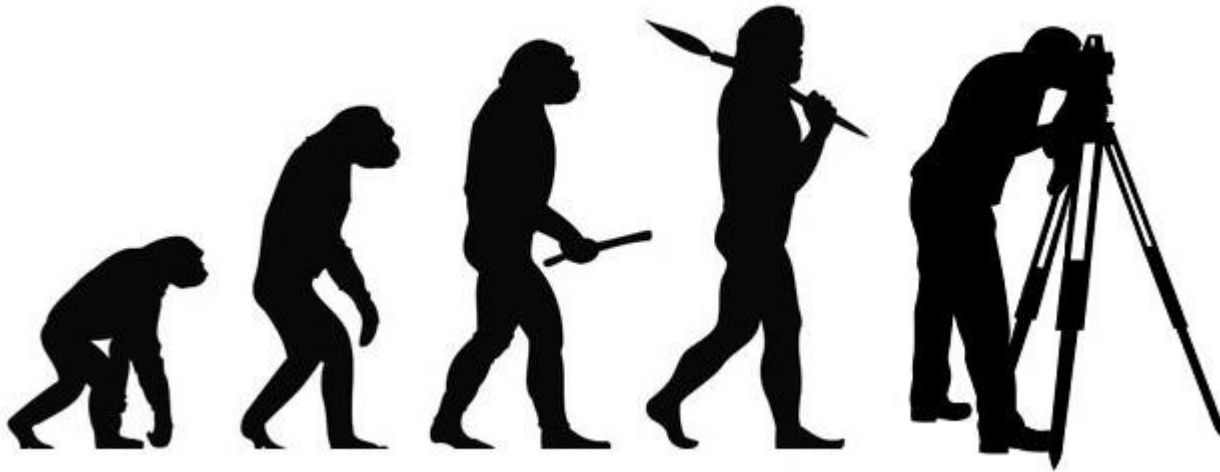


## IMPLEMENTING A COMMERCIAL UAV STRATEGY AT A MINE



## HISTORY OF SURVEY INSTRUMENTS





DUMPY LEVEL AND STAFF



The first geodetic leveling - the beginning of the vertical control network - was along the Hudson River in 1856



**CHAINS WITH LINKS**



**STEELTAPE**



**MECHANICAL THEODOLITES**



**DISTOMAT – ELECTRONIC DISTANCE MEASURING INSTRUMENT**



**TOTAL STATION - ELECTRONIC**



**GPS WITH BASE STATION**



**GPS – USING TRIGNET**



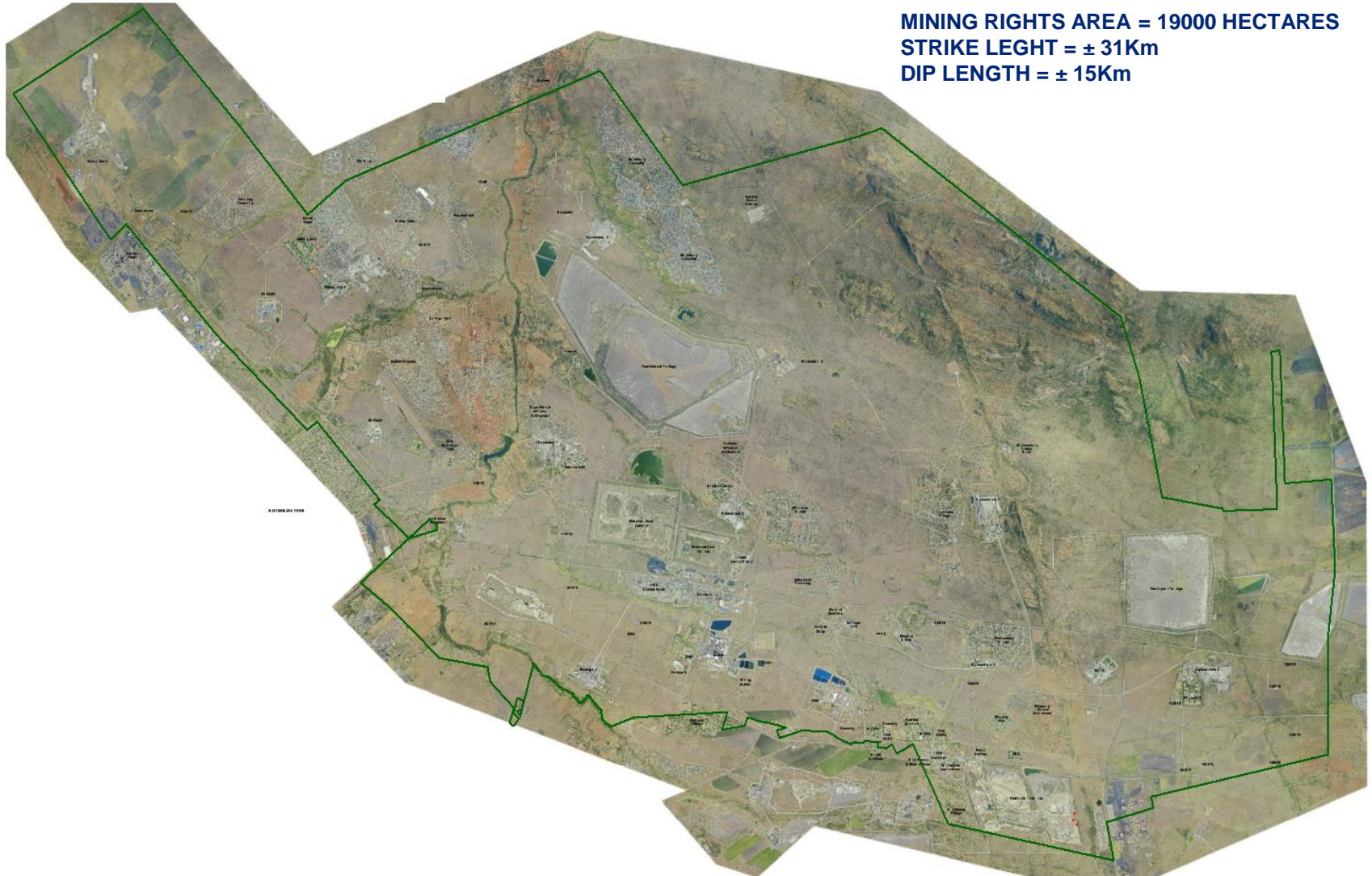
**3D LASER SCANNER**



REMOTE PILOTED AIRCRAFTS AND CAMERA







**MINING RIGHTS AREA = 19000 HECTARES**  
**STRIKE LENGTH = ± 31Km**  
**DIP LENGTH = ± 15Km**

---

## INTRODUCTION

The work load of the Surface Surveyor at the mine was steadily increasing and at the beginning of 2015 we realized that we will not cope by doing things the old way because:

- Quotations from Aerial Photography Companies to update mine surface plans continue to rise.
- National Environmental Management Act (NEMA) – mines are obligated to develop rehabilitation plans and annually demonstrate that concurrent rehabilitation has been undertaken
- The re-mining of tailings facilities by contractors. (Monthly volumetric surveys )
- More and more frequent volumetric surveys of reef stockpiles and waste rock dumps.
- Continues updating of Mine Plans
- Safety factors ( Working near dangerous high walls etc.)

Four options for the implementation of a Remote Piloted Aircraft System were considered:

- Contracting a registered RPAS company.
- Leasing aircrafts and doing the processing on mine
- Purchasing aircraft and have the processing done off mine
- Acquiring our own complete Remote Piloted Aircraft System. (Preferred option)

---

## **INTRODUCTION ( Cont...)**

After the decision to acquire our own RPAS, the following actions were necessary:

- Identify personnel for the project ( 3 pilots and 5 persons doing processing)
- Motivate the project with management
- Found a budget
- Decision on whether to purchase local manufactured or imported aircraft and they must be fit for purpose
- Ensuring that mapping standard will be met
- Ensure that flight manuals/User guides and maintenance manuals of aircraft to be purchased are approved by SACAA
- Purchase a complete package, hardware and software, including all training and mandatory examinations
- Ensure good after sale service
- Draw up a schedule and comply with it
- Join the Anglo American RPAS Steering committee and work group
- Trial between ground scanning and using RPAS.

**TYPICAL RPAS APPLICATIONS ON A MINE**

**DANGEROUS HIGH WALL**



**OPENCAST MINING**



**SLAG STOCKPILES (VERY FINE)**



**TAILINGS DAM (REMINING)**



## Survey Mapping Accuracies

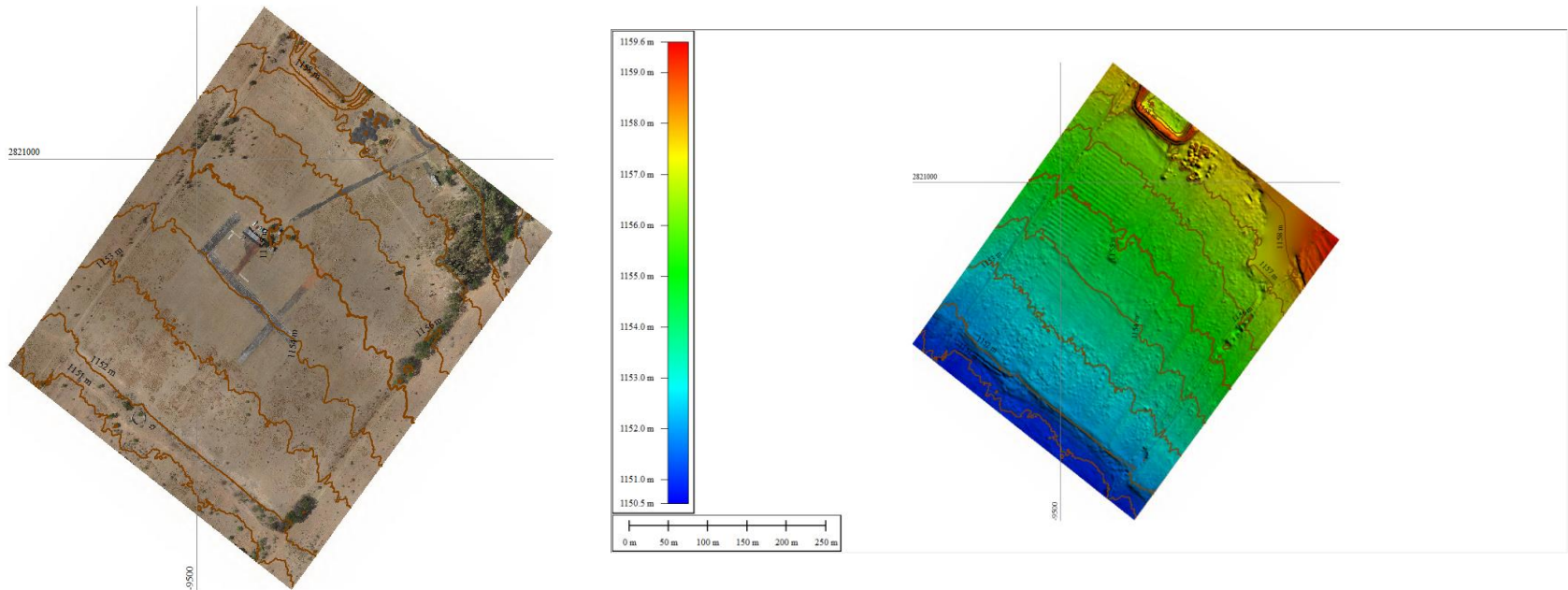
| Final Map/Plan Scale | Accuracy |       | Contour  | Typical Application of Stated Scale               |
|----------------------|----------|-------|----------|---|
|                      | X Y      | Z     | Interval |   |
|                      | RMS E    | RMS E | (m)      |   |
|                      | (m)      | (m)   | (m)      |   |
| 1:500                | 0.13     | 0.08  | 0.5      | Detailed Engineering and Design / Operation       |
| 1:1000               | 0.25     | 0.17  | 1        | Feasibility / Establishment / Operation / Closure |
| 1:2500               | 0.63     | 0.42  | 1.5      | Pre-feasibility                                   |
| 1:5000               | 1.27     | 0.84  | 2.5      | Pre-feasibility                                   |
| 1:10000              | 2.54     | 1.68  | 5        | Conceptual  |
| 1:20000              | 5.07     | 3.22  | 10       | Conceptual  |
| 1:50000              | 12.7     | 8.40  | 20       | Pre-conceptual / Conceptual                       |

Accuracies shown above are for ASPRS CLASS II maps expressed at 68% confidence.

RMSE = Root Mean Square Error

90% of all data points sampled on a map shall comply with the relevant RMSE accuracies tabled above.

## Survey Mapping Accuracies



| Count | X error (cm) | Y error (cm) | Z error (cm) | XY error (cm) | Total (cm) | Image (pix) |
|-------|--------------|--------------|--------------|---------------|------------|-------------|
| 4     | 1.8131       | 2.42069      | 2.09582      | 3.02441       | 3.67961    | 0.433       |

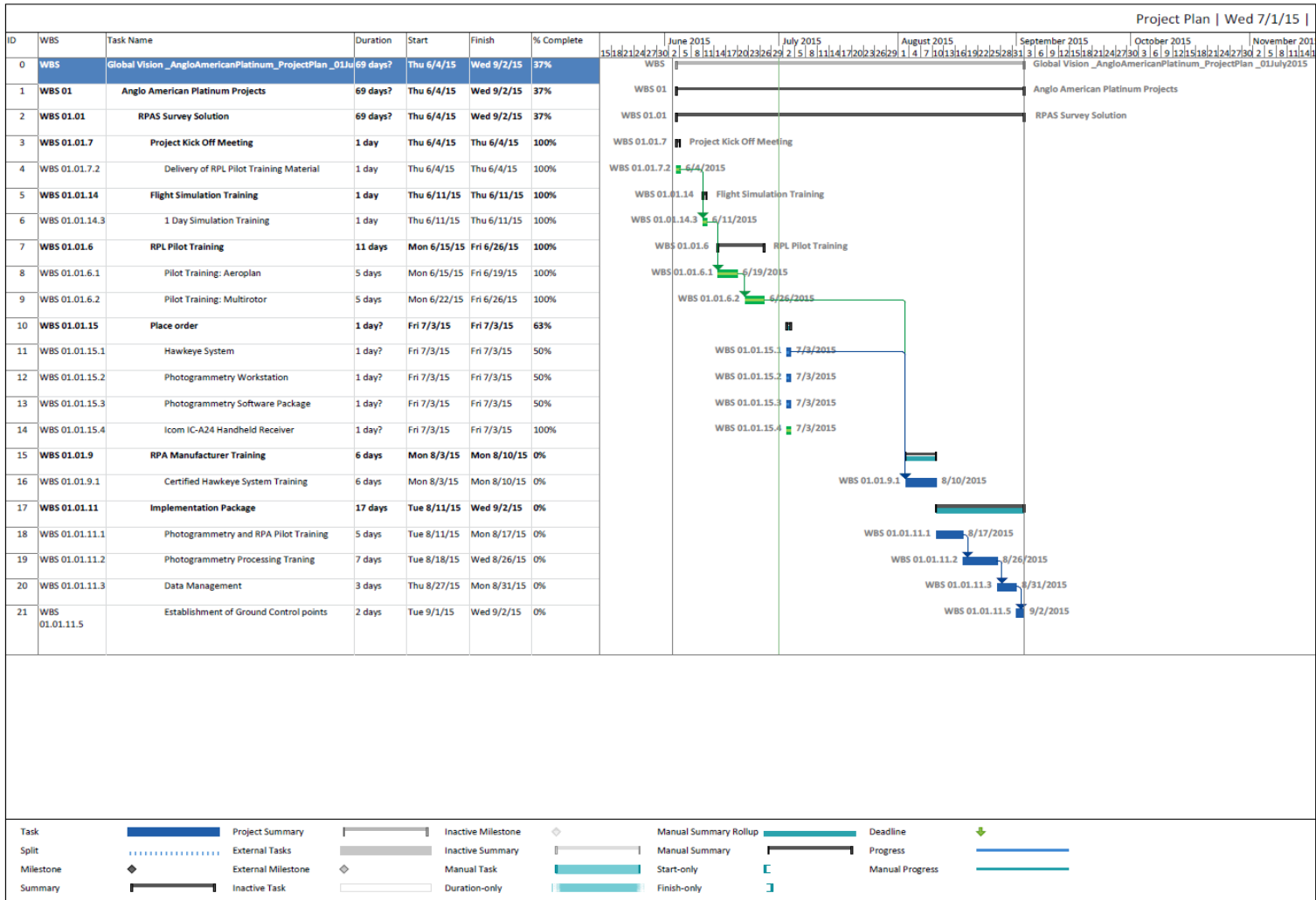
Table 2. Control points RMSE.

| Count | X error (cm) | Y error (cm) | Z error (cm) | XY error (cm) | Total (cm) | Image (pix) |
|-------|--------------|--------------|--------------|---------------|------------|-------------|
| 1     | 4.19467      | 0.452216     | 2.51665      | 4.21897       | 4.91256    | 0.453       |

Table 3. Check points RMSE.



## SCHEDULE FOLLOWED



## APPLICATION ROADMAP TO RPAS OPERATORS CERTIFICATE (SACAA Application Process)

- Pilot Licensing - Valid 24 Months; Revalidation Check
- RPAS Letter of Approval - Valid 12 Months; Annual Renewal
- RPAS Operator Certificate - Valid 12 Months; Annual Renewal Audit





---

## **PILOT LICENSING**

### Remote Pilot's License (RPL):

- Categories = A / MR / H

### Minimum Requirements:

- Not less than 18 years of age
- Class 4 Medical Certificate (Class 3 for B-VLOS)
- Valid restricted certificate of proficiency in radiotelephony
- English Language Proficiency
- Ground School – pass a Theoretical Knowledge Examination
- Flight Training – pass a Skills Test
- Revalidation check every 24 months (12 Months per AIC)

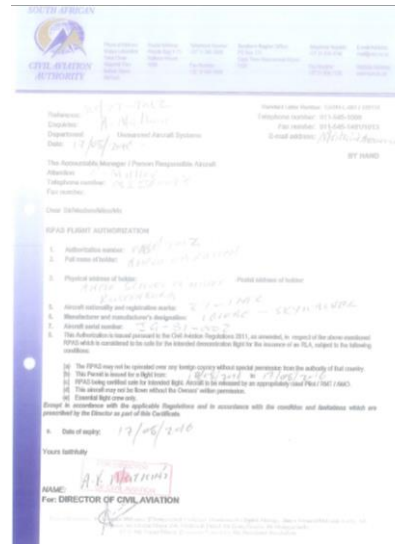
### RPA Observer training:

Internal training by Operator (ROC Holder)

## RPAS LETTER OF APPROVAL (RLA)

### RPAS to be flown:

- Certificate of Registration – registration markings on RPA
- RPAS Letter of Approval (RLA)-
  - Description of RPAS
  - Operating limitations
  - System Safety Requirements
  - Flight manual / User guide
  - Weight and Balance Certificate
  - Insurance Certificate
  - Test flight
- Certificate from ICASA
  - Radio Type Approval
- Maintenance Program
- Manufacturer training (OEM)



**CIVIL AVIATION AUTHORITY**

Reference: *17/09/2010* Date: *17/09/2010*

Description: *Unmanned Aircraft System*

This Authorization is issued pursuant to the Civil Aviation Regulations 2011, as amended, in respect of the above mentioned RPAS which is operated in the role for the intended operations flight for the issuance of an RLA, subject to the following conditions:

**RPAS FLIGHT AUTHORIZATION**

1. Identification number: *17/09/2010*
2. Full name of holder: *17/09/2010*
3. Physical address of holder: *17/09/2010*
4. Aircraft category and registration marks: *17/09/2010*
5. Manufacturer and manufacturer's designation: *17/09/2010*
6. Intended aerial work: *17/09/2010*

Signature: *[Signature]* Date: *17/09/2010*

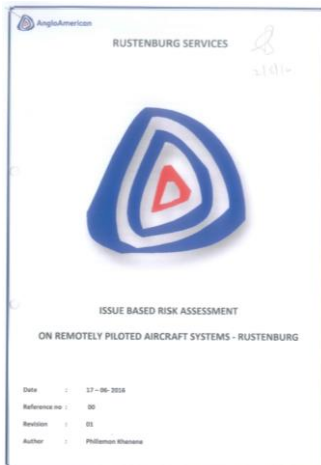
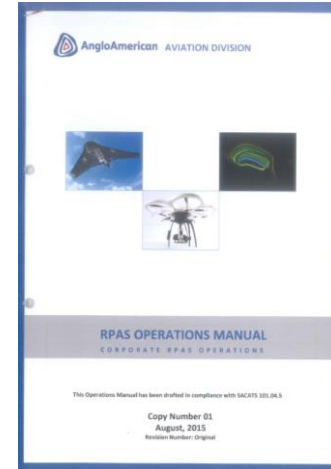
NAME: *[Signature]*  
FOR: DIRECTOR OF CIVIL AVIATION



## RPAS OPERATOR CERTIFICATE (ROC)

### Five phase application process

- Pre-Application
  - Formal Application
  - Submission of Documentation
  - Inspection and Demonstration – (concurrent with the RLA)
  - Approval
- Management Structure  
 Operations Manual  
 Emergency Response Plan  
 Site Specific Risk Assessment  
 Standard Operating Procedure



| Date       | Version | Prepared by | Type                         | Approved by |
|------------|---------|-------------|------------------------------|-------------|
| 17/08/2015 | 001     | [Signature] | Standard Operating Procedure | [Signature] |

- TITLE**  
RPAS Standard Operating Procedure
- PURPOSE**  
To ensure the safe and effective operation of RPAS in accordance with aviation, surveying and mining standards. This SOP (Standard Operating Procedure) will apply to operating a RPAS system at Rustenburg Platinum Mines. This document is drafted in accordance with the Anglo American RPAS Operations Manual and is supported by OIR manual and checklists.

- REVIEW TEAM**  
The following persons gave input during the drafting / revision of this procedure.  
All team must include all relevant stakeholders from Survey, Safety, Aviation, Operations.

| Name and Surname | Designation                      | Signature   |
|------------------|----------------------------------|-------------|
| J Van Der Merwe  | Chief Surveyor, Rustenburg Mines | [Signature] |
| EJ Bontje        | Chief Surveyor, Land Management  | [Signature] |
| M Andri          | Chief Surveyor, Bathopelle       | [Signature] |
| AI Maritz        | Exploration Surveyor             | [Signature] |

- RECORD OF AMENDMENT**

| Revision Number | High Number(s) | Change effective | Status |
|-----------------|----------------|------------------|--------|
|                 |                |                  |        |

- REFERENCES**  
This procedure has been drafted with reference to the following documents:
- | Document Number             | Document Title  | Type of Document  |
|-----------------------------|---|-------------------|
| Part 101 Regulations        | Part 101 Regulations of Civil Aviation Act 2001 Act No 33 of 2001 | Regulations       |
| RPAS Operations Manual      | Anglo American RPAS Operations Manual                             | Operations Manual |
| SISA 29 of 1996, Chapter 17 | Labour Health and Safety Act 29 of 1996, Chapter 17               | Regulations       |

**ISSUED: CONTROL PLAN**

**RUSTENBURG SURFACE SERVICES**  
RUSTENBURG PLATINUM MINES (PTY) LTD

| Control Number(s) | Issued by                        | Description and reason for change |
|-------------------|----------------------------------|-----------------------------------|
| 1                 | Chief Surveyor, Rustenburg Mines | Initial Issue                     |

| Control Number(s) | Issued by | Description and reason for change |
|-------------------|-----------|-----------------------------------|
|                   |           |                                   |

Issued on: 01 October 2015

Chief Surveyor: [Signature]  
 Head of Engineering and Technical Services: [Signature]  
 Date: 16/10/15

---

## **OPERATIONAL READINESS CHECKLIST**

This checklist is based on the requirements to operate RPAS at Anglo American Platinum Rustenburg section as described in the following documents:

- Part 101 of the SA-Car ( Civil Aviation Regulations)
- Part 101 of the SA-CATS ( Civil Aviation Technical Standards)
- Anglo American RPAS Operational Manual
- MHSA 29 of 1996, Chapter 17
- Anglo American Platinum Best Practice Guide
- Remote Piloted Aircraft System Standard Operating Procedure ( SOP) - operation
- Rustenburg Services – Issue Based Risk Assessment
- Rustenburg Services – Emergency Response Plan

## OPERATIONAL READINESS CHECKLIS (cont...)

### Organizational and Operational Control:

- Roles and Responsibilities
- RPAS Operational Suitability
- Qualifications of post holders
- RPAS Operations
- Crew health ( Class 4 medical certificate)
- Documents and record keeping
- Flight crew composition
- Operating multiple aircraft categories

### Operational procedures:

- Flight planning and preparation ( SOP)
- Emergency procedures

### Training program: Initial training:

- Training records
- Validity of training

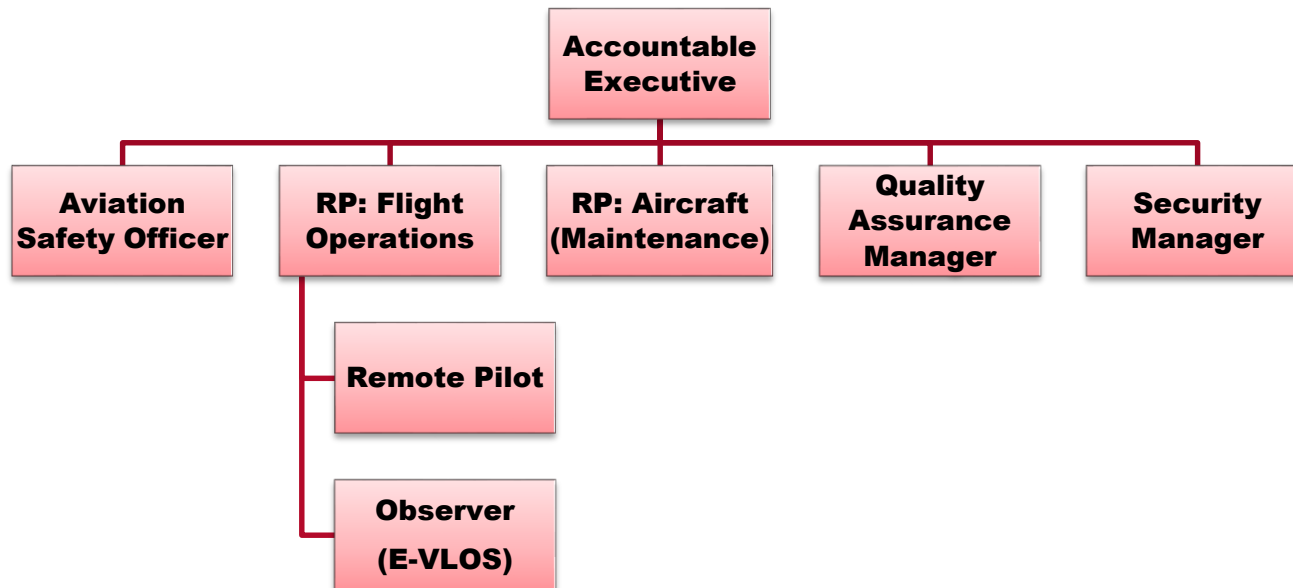
### Safety and security:

- Pre-flight checks and searches
- Prevention of unauthorized access
- Protection of C2 links
- Background and criminal record checks



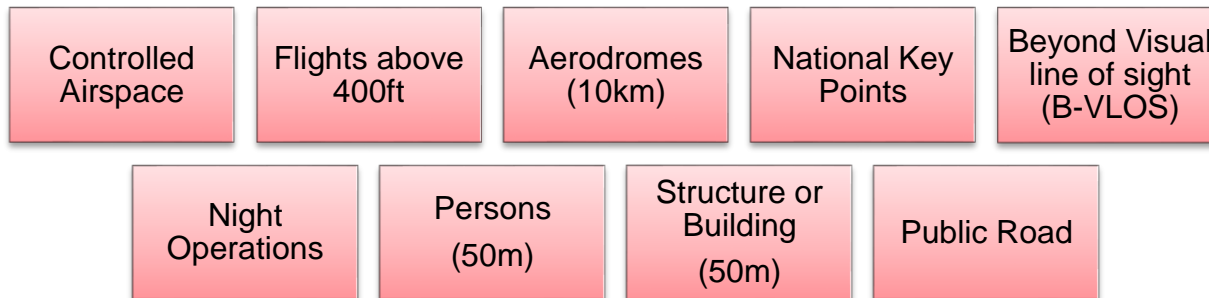
## ROC Applicant

Management Structure: required by SACAA



## Limitations and Prohibitions

“Except by the holder of an ROC and as approved by the Director of Civil Aviation”



## Details of system purchased

### Hardware

- AKS Raven and Sony QX1 camera with Sony 16mm Lens. Complete with SACAA approved flight and maintenance manuals – Locally manufactured and Certified Manufactural Training
- Skywalker and Sony QX1 camera with Sony 16mm Lens. Complete with SACAA approved flight and maintenance manuals – Locally manufactured and Certified Manufactural Training
- UX5 and Sony NEX-5R camera and Sony 15mm Lens – Imported (with compliments from AA Research and Development Team)
- Two Discovery training planes (wheels) complete with batteries, battery charger, battery tester, receiver, tool box with tools, lipo bags, spares
- Two Sky Surfers training planes (hand launch) - complete
- AKS Y6 multicopter training multi copter - complete
- Photogrammetry Workstation (Intel Core i7 5930K-3.50GHz Six Core)
- Two Icom IC-A24 Air-band radios and licencing
- Two Motorola two way radios
- Three flight Simulators
- Insurance for the Raven, Skywalker and UX5
- Suitable vehicle (Double cab with lockable canopy)



### Software

- Agisoft PhotoScan – Professional Edition
- Microstation PowerInRoads



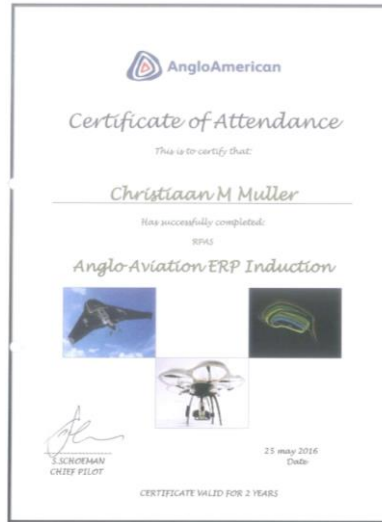
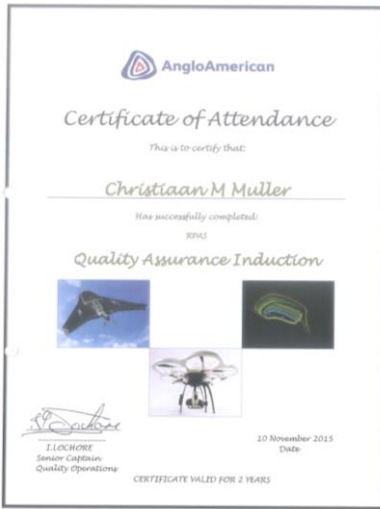
## THEORETICAL TRAINING

### Theoretical training subjects and examinations: Pass mark 75%

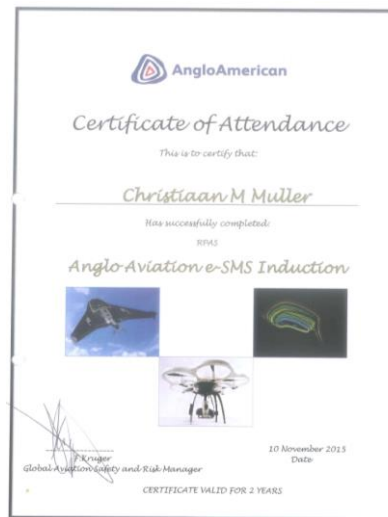
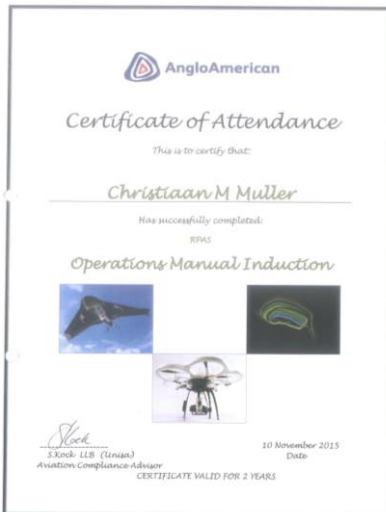
- Air Law 101
- Human performance
- RPAS Construction and flight (Multirotor)
- RPAS Construction and flight (Airplane)
- Radio links
- Meteorology
- Navigation
- Batteries
- Restricted Radiotelephony Proficiency Certificate
- Certificate of Competence in ICAO English Language Proficiency
- EMPS Screening Validation Certificate
- RPAS Quality Assurance Certificate – valid for 2 years
- Anglo Aviation e-SMS Induction – valid for 2 years
- RPAS Operations Manual Induction – valid for 2 years
- Aviation Security Awareness Training – valid for 2 years
- Anglo Aviation ERP Induction – valid for 2 years
- Photogrammetry training



# CERTIFICATES




| EMPS SCREENING VALIDATION REPORT |   |                                 |                  |
|----------------------------------|---|---------------------------------|------------------|
| CLIENT                           | PROFESSIONAL AVIATION SERVICES (P) (Pty) Ltd. 154, RALPH DUNN ROAD, BENTONVILLE, SOUTH AFRICA | CURRENT CODE                    | 8881             |
| BRANCH OR DIVISION               | HEAD OFFICE   | ISSUE CODE                      | 1001             |
| REQUESTED BY                     | ELIJAH WOLMAN   | YOUR REFERENCES                 |                  |
| PASS NUMBER                      |   |                                 |                  |
| TELEPHONE                        | 011 751 5331  |                                 |                  |
| CANDIDATE                        | CHRISTIAAN MULLER   | ISSUE REFERENCE                 | 100004           |
| IDENTIFIER                       | 191110001001  | ISSUE TYPE                      | 61 - RENEWAL     |
| <b>ISSUES</b>                    | <b>STATUS</b>   | <b>REQUESTED</b>                | <b>COMPLETED</b> |
| AVIATION MANAGEMENT CHECK        | COMPLETE  | 2015-10-13 17:27                | 2015-11-26 15:15 |
| 61 - IDENTIFICATION              | COMPLETE  | 2015-10-13 17:27                | 2015-11-26 15:15 |
| DRIVERS LICENSE VERIFICATION     | COMPLETE  | 2015-10-13 17:27                | 2015-11-26 15:15 |
| <b>DESCRIPTION</b>               | <b>ISSUE 1</b>  | <b>ISSUE 2</b>                  | <b>ISSUE 3</b>   |
| CHECK - 100703                   | CLEAR   | CHECKED CHECK RESULTS           | 61 - RENEWAL     |
| AVIATION MANAGEMENT CHECK        |   | 61 - IDENTIFICATION             | 61 - RENEWAL     |
| CHECK - 100704                   | CONFIRMED   | SEE ATTACHED HOME ATTEND REPORT |                  |
| 61 - IDENTIFICATION              |   |                                 |                  |
| SUPPORTING DOCUMENTS             |   |                                 |                  |
| 61 - IDENTIFICATION              |   |                                 |                  |
| CHECK - 100705                   | CONFIRMED   | CODE 4 - 09                     |                  |
| DRIVERS LICENSE VERIFICATION     |   | ISSUE NUMBER 4110000001         |                  |
|                                  |   | ISSUE DATE 2009-11-15           |                  |
|                                  |   | ISSUE TYPE 61 - RENEWAL         |                  |



## Practical training


- Simulator – both multirotor and airplane (Practical exam invigilated by an SACAA accredited examiner )
- Two week airplane and multirotor training and then a Letter of Recommendation by an SACAA accredited Instructor to the SACAA Designated Flight Examiner. Then the DFE testing.
- Original Equipment Manufacturers (OEM)
- Constant practising

## SIMULATOR

## RPAS TRAINING ACADEMY AIRFRAMES @ CORSAIR RC FIELD

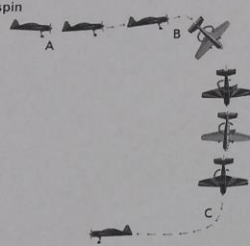


## SOME OF THE TRAINING MANOEUVRES (13 in total)


**RPL (A): Simulator Phase 2 - Lesson 10**  
 ©RPAS Training Academy 2015 2015-05-01

|                 |            |   |  |
|-----------------|------------|---|--|
| Date            | 20 - - - - | <i>Instructions: if more than one day is required then use a new sheet.</i> |  |
| Student Name    |            | Student Licence   |  |
| Instructor Name |            | Instructor Licence  |  |

**Recovery from spin** **1 hour**




| Flights  | De-brief | Grading         |   |   |   |   |   |   |
|----------|----------|-----------------|---|---|---|---|---|---|
| Flight 1 |          | minutes         | 1 | 2 | 3 | 4 | 5 | C |
|          |          | Student sig.    |   |   |   |   |   |   |
|          |          | Instructor sig. |   |   |   |   |   |   |
| Flight 2 |          | minutes         | 1 | 2 | 3 | 4 | 5 | C |
|          |          | Student sig.    |   |   |   |   |   |   |
|          |          | Instructor sig. |   |   |   |   |   |   |
| Flight 3 |          | minutes         | 1 | 2 | 3 | 4 | 5 | C |
|          |          | Student sig.    |   |   |   |   |   |   |
|          |          | Instructor sig. |   |   |   |   |   |   |
| Flight 4 |          | minutes         | 1 | 2 | 3 | 4 | 5 | C |
|          |          | Student sig.    |   |   |   |   |   |   |
|          |          | Instructor sig. |   |   |   |   |   |   |

|  |  |
|--|--|
| 1 Requires considerable future training            | 4 A good standard with no ingrained faults |
| 2 Requires some further training                   | 5 A polished standard                      |
| 3 Satisfactory after instructors input/ correction | C Lesson Completed                         |

**Student has completed the above lesson**

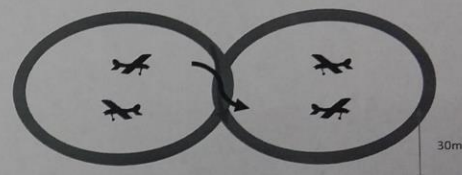
|                   |                      |
|-------------------|----------------------|
| Student signature | Instructor signature |
|-------------------|----------------------|

Page 1 of 1


**RPL (A): Simulator Phase 2 - Lesson 8**  
 ©RPAS Training Academy 2015 2015-05-01

|                 |            |   |  |
|-----------------|------------|---|--|
| Date            | 20 - - - - | <i>Instructions: if more than one day is required then use a new sheet.</i> |  |
| Student Name    |            | Student Licence   |  |
| Instructor Name |            | Instructor Licence  |  |

**Horizontal figure of eight (both directions)** **1 hour**



| Flights  | De-brief | Grading         |   |   |   |   |   |   |
|----------|----------|-----------------|---|---|---|---|---|---|
| Flight 1 |          | minutes         | 1 | 2 | 3 | 4 | 5 | C |
|          |          | Student sig.    |   |   |   |   |   |   |
|          |          | Instructor sig. |   |   |   |   |   |   |
| Flight 2 |          | minutes         | 1 | 2 | 3 | 4 | 5 | C |
|          |          | Student sig.    |   |   |   |   |   |   |
|          |          | Instructor sig. |   |   |   |   |   |   |
| Flight 3 |          | minutes         | 1 | 2 | 3 | 4 | 5 | C |
|          |          | Student sig.    |   |   |   |   |   |   |
|          |          | Instructor sig. |   |   |   |   |   |   |
| Flight 4 |          | minutes         | 1 | 2 | 3 | 4 | 5 | C |
|          |          | Student sig.    |   |   |   |   |   |   |
|          |          | Instructor sig. |   |   |   |   |   |   |

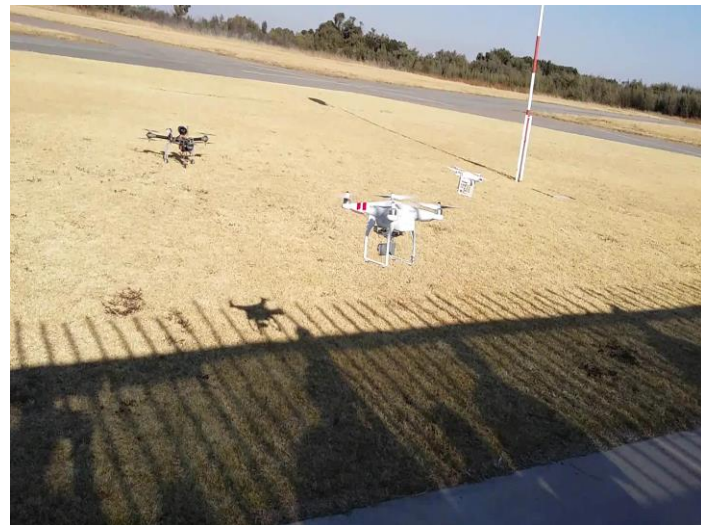
|  |  |
|--|--|
| 1 Requires considerable future training            | 4 A good standard with no ingrained faults |
| 2 Requires some further training                   | 5 A polished standard                      |
| 3 Satisfactory after instructors input/ correction | C Lesson Completed                         |

**Student has completed the above lesson**

|                   |                      |
|-------------------|----------------------|
| Student signature | Instructor signature |
|-------------------|----------------------|

Page 1 of 1

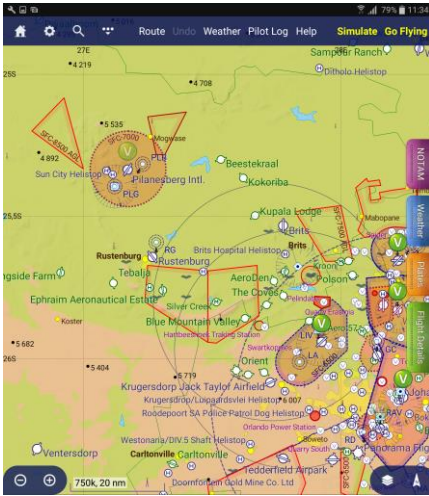
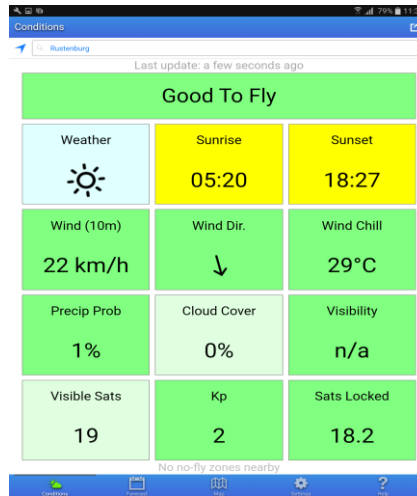
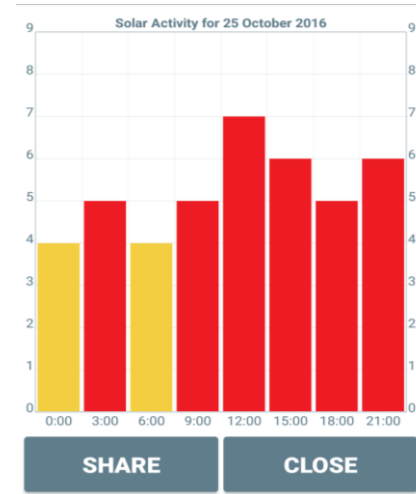
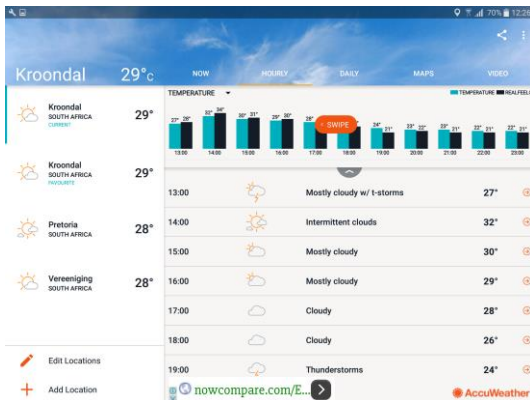
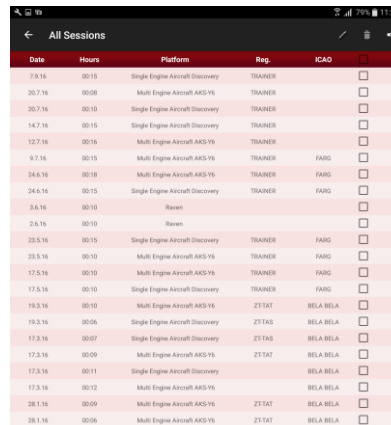
**PRACTICAL TRAINING - FIXED WING AND MULTIROTOR**



## TRAINING AIRFRAMES



# FLIGHT PREPARATIONS APPLICATIONS ( Tablets)

**Aeronautical Maps**

**Flight Forecast**

**Solar Activity**

**Weather Forecast**

**Flight Logbook**


| Date    | Hours | Platform                         | Reg.    | ICAO      |
|---------|-------|----------------------------------|---------|-----------|
| 7.9.16  | 00:15 | Single Engine Aircraft Discovery | TRAINER |           |
| 30.7.16 | 00:06 | Multi Engine Aircraft A32-Y6     | TRAINER |           |
| 30.7.16 | 00:10 | Single Engine Aircraft Discovery | TRAINER |           |
| 14.7.16 | 00:15 | Single Engine Aircraft Discovery | TRAINER |           |
| 12.7.16 | 00:16 | Multi Engine Aircraft A32-Y6     | TRAINER |           |
| 9.7.16  | 00:15 | Multi Engine Aircraft A32-Y6     | TRAINER | FARG      |
| 24.6.16 | 00:18 | Multi Engine Aircraft A32-Y6     | TRAINER | FARG      |
| 24.6.16 | 00:15 | Single Engine Aircraft Discovery | TRAINER | FARG      |
| 9.6.16  | 00:10 | None                             |         |           |
| 2.6.16  | 00:10 | None                             |         |           |
| 23.5.16 | 00:15 | Single Engine Aircraft Discovery | TRAINER | FARG      |
| 23.5.16 | 00:10 | Multi Engine Aircraft A32-Y6     | TRAINER | FARG      |
| 17.5.16 | 00:10 | Multi Engine Aircraft A32-Y6     | TRAINER | FARG      |
| 17.5.16 | 00:10 | Single Engine Aircraft Discovery | TRAINER | FARG      |
| 19.3.16 | 00:10 | Multi Engine Aircraft A32-Y6     | Z1TAT   | BELA BELA |
| 19.3.16 | 00:06 | Single Engine Aircraft Discovery | Z1TAT   | BELA BELA |
| 17.3.16 | 00:07 | Single Engine Aircraft Discovery | Z1TAT   | BELA BELA |
| 17.3.16 | 00:09 | Multi Engine Aircraft A32-Y6     | Z1TAT   | BELA BELA |
| 17.3.16 | 00:11 | Single Engine Aircraft Discovery |         | BELA BELA |
| 17.3.16 | 00:12 | Multi Engine Aircraft A32-Y6     |         | BELA BELA |
| 28.1.16 | 00:09 | Multi Engine Aircraft A32-Y6     | Z1TAT   | BELA BELA |
| 28.1.16 | 00:06 | Multi Engine Aircraft A32-Y6     | Z1TAT   | BELA BELA |

PRACTICAL TRAINING AND TESTING



LETTER OF RECOMMENDATION TO THE DFE FROM THE ACADEMY'S SACAA ACCREDITED INSTRUCTOR



THE DESIGNATED FLIGHT EXAMINER INTERVIEW (40 minutes)



THE DESIGNATED FLIGHT EXAMINER TEST





## PRESENTATION OF THE RPAS PILOT LICENCE AT SACAA



## ON MINE RPAS FLIGHT REQUIREMENTS

### Letters of consent:

- Land owners
- Local Airfield

### On mine consent:

- Protection Services
- General Manager
- Head of Engineering

### Flight Checklists:

- Ground Control Point Planning cf
- Flight Planning Checklist
- Equipment Checklist
- Pre-Site Risk Assessment
- On-Site Risk Assessment
- Pre-Flight Checklist
- Post Flight Checklist
- Flight Safety Assessment
- Flight Briefing
- Battery Log/Flight folio
- Incident Report



4 July 2016

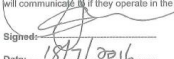
Rustenburg Local Municipality  
P O Box 16  
Rustenburg  
0300

Attn: Mr Jan Pieters

Dear Sir,

CONSENT: Rustenburg Municipality for Rustenburg Platinum Mines Ltd. to operate a Radio Piloted Aircraft System on the property of Rustenburg Local Municipality within the Mining Rights Area of Rustenburg Platinum Mines Ltd.

Type of Operation: RPAS Aerial Operation  
Area of Operation: Please see attached plan  
Dates of Requirements: 18 July 2016 – 31 December 2016  
Duration of the Operations: 07:00:00(L) – 17:00:00(L)  
Vertical limits of the areas: Below 400 Feet, Above Ground Level  
Aircraft type: Multi Rotor and Fixed Wing  
Additional comments: RPAS pilots will communicate on frequency 122.400 and monitor 124.800. RPAS pilots will take avoidance action when they have visual of manned aircraft and will communicate if they operate in the flight path of manned aircraft.

Signed: 

Date: 18/7/2016

  
Yours in safe and profitable platinum

Enslin G Beetge  
Remote Base Manager

A member of the Anglo American plc group  
Rustenburg Platinum Mines Office  
Business Address: Main Offices, Rustenburg, 0300, P O Box 1, Steynburg, Rustenburg, 0300, South Africa.  
P: +27 (0) 14 568 8111 F: +27 (0) 14 568 1100

Rustenburg Platinum Mines Limited  
Registered Address: 55 Marais Street, Johannesburg, 2001, P O Box 52176, Market Square, 2017 South Africa. T: +27 (0) 11 8782111 F: +27 (0) 11 3706111  
Incorporated in South Africa. Registration Number: 193 000 380 000  
Directors: GJ Carlin (Chairman) / Balika Kivela (Managing Director) / L Mager / J Mokoena / J Ndlovu-Dube / J P Phiso / M Poojari / GJ Smith  
Company Secretary: Anglo-Platinum Proprietary Limited

SECURITY CLASSIFICATION

PLATINUM  
Rustenburg Platinum Mines Limited  
MAIN OFFICES  
Klipfontein  
Rustenburg  
0292  
South Africa

Ref: LMSS084



Rustenburg Platinum Mines Ltd

### RAVEN - EQUIPMENT CHECK LIST

|                 |  |            |  |
|-----------------|--|------------|--|
| Company:        |  | Flight #:  |  |
| Site:           |  | Project #: |  |
| Date of Flight: |  | Pilot:     |  |

| Complete the required information fields below |                            |       |
|--|----------------------------|-------|
| Item   | Description                | Check |
| 1  | Hard Case (Equipment Case) |       |
| 2  | Raven                      |       |
| 3  | Radio                      |       |
| 4  | Batteries                  |       |
| 5  | Charger                    |       |
| 6  | Camera                     |       |
| 7  | Camera Batteries           |       |
| 8  | Camera Charger             |       |
| 9  | Memory Card                |       |
| 10   | Invertor / Power Supply    |       |
| 11   | Laptop                     |       |
| 12   | 12V Battery                |       |
| 13   | Epoxy                      |       |
| 14   | Table                      |       |
| 15   | Chair                      |       |
| 16   | Data Link and Aerial       |       |
| 17   | Battery Tester             |       |
| 18   | Tampering with RPAS holder |       |
| 19   | Tampering with Strong Room |       |
| 20   | Tampering with Canopy      |       |

### Acceptance

Name: \_\_\_\_\_

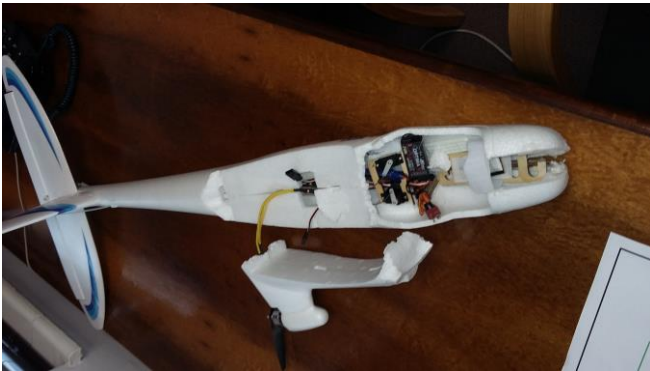
Designation: \_\_\_\_\_

Date: \_\_\_\_\_

Signature: \_\_\_\_\_

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## CONCLUSION



### POSSIBLE CONSEQUENCES OF USING UNREGISTERED REMOTE PILOTED AIRCRAFT SYSTEMS

Putting your mine at risk due to:

- Aviation accidents or incidents
- No third party insurance
- No radio communication with manned aircraft
- No knowledge of separation and avoidance manoeuvres
- Batteries/ fire hazards (Storage, charging, transportation and discarding)
- Illegal flying within a lateral distance of 50m from people, public roads, structures or buildings
- Flying within 10km of airports
- Flying within restricted or prohibited airspace
- Lack of understanding of the dangers of solar flares (GPS loss)
- Serious fines can be imposed on the mine/closing the mine

LIPO BATTERIES



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## **ACKNOWLEDGEMENTS**

- DONOVAN ANDERSEN – MANAGER: SURVEY AND MRM SYSTEMS
- GAWIE VAN HEERDEN – MINERAL RESOURCE MANAGER
- SONET AND ROBIN KOCK – AVICOMPLY
- DEON, CRAIG, VAUGHN AND ALBERT – RPAS ACADEMY
- ANDREW MACHELE AND MAURITZ MULLER – PILOTS
- ANGLO AMERICAN PLATINUM – RUSTENBURG SECTION MANAGEMENT
- ANGLO AMERICAN AVIATION DEPARTMENT
- ANGLO AMERICAN RPAS STEERCOM
- UNITED DRONE HOLDINGS



**I THANK YOU !!!**