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GENERAL NOTICE

NOTICE 2200 OF 1999

Safety in Mines Research Advisory Committee

Invitation to submit proposals for SIMRAC projects

SIMRAC was established in terms of the Mine Health and Safety Act (29/1996) to conduct research and surveys regarding, and for the promotion of, health and safety at mines in the South African Mining Industry.

SIMRAC, on behalf of the Department of Minerals and Energy, invites suitably qualified agencies and/or persons to submit proposals to undertake the projects listed below. Prospective proposers must observe the following instructions when compiling submissions:

(a) Proposals must be submitted in accordance with the standard format available from SIMRAC Project Support Services (SIMPROSS). Contact Mrs C Jones at telephone 011 358 9182, fax 011 403 1821, e-mail cjones@simpross.co.za or visit the SIMRAC websites http://www.simrac.co.za or http://www.simpross.co.za to download the submission templates.

(b) SIMRAC will hold a site meeting, open to all interested parties, at which the aims and objectives of the projects listed in this notice will be discussed and queries will be answered. All prospective proposers are urged in their own interests to attend the meeting. The site meeting will be held on:

Monday 11 October 1999, from 09:00 to 12:00, in the Committee Room, SIMPROSS offices, 2nd Floor, Braamfontein Centre, cnr Jorissen Street and Jan Smuts Avenue, Braamfontein.

For prospective proposers who are unable to attend the site meeting, queries can be forwarded to SIMPROSS, tel. 011 358 9180 or pvdheever@simpross.co.za.

(c) The closing time and date for the submission of proposals is **12:00 on Friday 29 October 1999.** Late entries will not be accepted.

(d) Two copies of each proposal, in a form suitable for photocopying, must be deposited in the repository labelled "SIMRAC proposals" at the SIMPROSS offices, during normal business hours prior to the closing time and date mentioned in paragraph (c).

(e) SIMRAC may at its sole discretion decide to recommend the acceptance or rejection of any proposal or may attempt to renegotiate proposals prior to recommending acceptance or rejection. Neither SIMRAC nor the Department shall furnish any reasons for their decisions regarding proposals.

(f) Every proposal accepted by the Department of Minerals and Energy will be subject to a standard set of terms and conditions which will, on acceptance of the proposal, form part of the contract applicable to the project. All prospective proposers should peruse a set of the standard terms and conditions prior to submitting a proposal. A copy of the standard terms and conditions for 2000 is attached to this Notice. Further copies are available from SIMPROSS on request.

(g) In compiling proposals, prospective proposers should provide full details regarding each identifiable output and its estimated costs. Personnel to be employed on each output should be identified and should be costed separately, within the standard format.

(h) SIMRAC requires full disclosure regarding all subcontracts included in the proposal.

(i) Where an output includes a device, mechanism, procedure, or system capable of being applied in the mining environment, a prospective proposer shall include in the proposal an output which suggests how the outputs in question might best be applied in practice. In drafting proposals, all prospective proposers should bear in mind the potential for technology transfer.

(j) Each successful proposer may, during the contract period or shortly after its completion, be required to provide:

- A competent spokesperson with appropriate materials to make not more than two separate presentations, on an annual basis for the duration of the project, and
- A technical paper on the project for publication in the SIMRAC Symposia proceedings, without additional remuneration or reimbursement of costs.

The services to be provided in terms of this paragraph must be detailed and costed as a separate output.

(k) Where relevant, proposers may obtain copies of earlier project reports and other information from SIMRAC Project Support Services (SIMPROSS) at the address given under (b) above.

(l) Proposers are advised that all SIMRAC projects may be subjected to technical and financial audits, both during and on completion of contracts and all relevant information, for instance capital equipment, should be recorded for such audits.

(m) Proposers should motivate and cost all proposed travel outside the borders of South Africa in connection with the project, and provide details of all expenses such as travel, subsistence etc.

(n) All proposed project costs must be expressed in South African rands. Fluctuations in the exchange rate and purchase of forward cover should be considered when costing the proposal.

(o) Proposers will be notified of the outcome of submissions during March 2000.

COAL MINING

Project reference number: COL 701

Project title
To develop best practice inertisation strategy for inbye area of underground fiery collieries

Motivation
To pro-actively prevent/arrest gas or coal dust explosions from proceeding beyond the inbye area.

Primary outputs
1. Identification of inertisation technology/techniques/best practice world wide
2. Evaluation of best practice for efficient inertisation
3. Formulation of best practice strategy for inbye areas for U/G fiery collieries

Above to be researched and reported under the following seam heights:

- Less than 1,8 metres
- 1, 8 to 3, 6 metres
- 3,6 metres and higher

Scope

1. Efficacious (best practice) inertisation strategy for inbye area of underground fiery collieries
2. Desk top survey of publicised best practice, world wide
3. Review and critical evaluation of inertisation technology/best practice (including wet stone dust technology)

Duration
12 months (12 work-months)

Potential for application
All underground fiery collieries with significant occupational health and safety risk of gas explosions and coal dust explosions in the above areas of mines.

Requirement for technology transfer
Fit for purpose, user friendly and appropriate recommendations in respect of technology transfer under typical South African conditions and core business processes

Special skills required from project team
1. Competence in respect of South African coal mining conditions
2. Research competence
3. Competence in respect of inertisation best practice/technology
4. Competence in respect of significant Occupational Health and Safety risks associated with gas/coal dust explosions

Project reference number: COL 702

Project title
Current practice and guidelines for the safe design of water barrier pillars

Motivation
Naturally occurring and stored underground water poses a threat to the safety of underground employees on coal mines. Often underground working are sited close to an underground reservoir. The safe distance that working excavations should be kept from such water bodies is determined by experience rather than sound rock mechanics and engineering principles. Guidelines for the safe practical layout and design of water barrier pillars is needed for coal measure rocks where high k-ratios may be present. Guidelines are needed for the management and reduction of the risk of water barrier pillar failures.

Primary output
1. Review of the current practice of water barrier pillar design.
2. A methodology for the design of water barrier pillars in coal measure rocks.
3. Guidelines for the dimensions of barrier pillars that will ensure that the rapid inflow of water into workings from underground reservoirs does not occur.

Scope of research
1. A survey of the current practice of water barrier pillar design locally and internationally.
2. Determining the critical geotechnical factors which impact on the strength and permeability of a pillar and surrounding strata.
3. Conduct an underground study to observe the conditions of existing water barrier pillars
4. Limited numerical modelling of pillars with a variety of conditions.
5. Design charts and simple computer program for the establishment of safe water barrier pillars.
6. Determine a methodology for establishing the true head of water

Duration
12 months

Potential impact application
High

Requirement for technology transfer
Clear design principles in a brief report with design charts that may be easily used. These should be published in a booklet and simple computer based package.
Workshops for the relevant personnel involved in mine layout and design.

Special skills required from project team:
1. Rock mechanics knowledge in coal mining.
2. Mine layouts experience
3. Access to laboratory facilities to test rock strengths and permeability.
4. Underground instrumentation and monitoring
5. Numerical modelling skills

Project reference number: COL 703

Project title
Pre-feasibility investigation of system to provide early warning of roof falls prior to support installation

Motivation
Warning of roof falls at the face before support is installed is currently limited to observational methods. Roof rock failing in compression emits both electromagnetic and sound waves before the roof falls. This therefore provides the possibility of providing a warning of a potential fall. Action could be taken to prevent a fall and to modify the mining system whilst the conditions persist. This should lead to a reduction in roof falls.
A warning device which was reliable and able to discriminate rock failure from other noise would represent an important step forward in safety.
This project could lead to the development of a device which would provide warning of a roof fall in active roadway developments.
This would provide the operator with the opportunity to take actions to prevent a fall and to modify his mining methods to reduce the likelihood of roof failure.

Primary output
Results of a programme of laboratory monitoring of emission of sound and electromagnetic radiation and its relation to roof failure at the face of roads being mined.
Proto-type equipment to measure deformation.
An analysis of this information indicates potential feasible warning systems.

Scope
1. Construct equipment to collect data in a laboratory environment
2. Record emission at a number of active roadway developments where roof failure is occurring.
3. Carry out detailed analysis of the data to establish suitable means of discrimination of potential roof fall situations from background noise
4. Report

Duration
3 months

Potential for application
High

Requirement for technology transfer
The results should be reported to interested parties and allow the commercial development of a practical device.

Special skills required from project team
1. Knowledge of instrumentation and the mechanics of coal mine roof failure.

Project reference number: COL 704

Project title
Suitable long tendon (2.5m - 15m) technologies and practices

Motivation
Long tendons of a variety of descriptions are used extensively in coal mines. The application of the best tendon for a particular situation is important for safety but it also has financial implications. The different type of tendons for different applications means that often the incorrect tendon may be installed. A catalogue of the different tendons used on the mines and the most suitable application for each type needs to be compiled. The requirements for good installation and the limits of acceptable practice need to be documented.

Primary output
A manual of best practice for the effective installation of tendons commonly in use on coal mines

Scope
Survey of usage of long tendon support on a representative cross section of coal mines
Best practice on the mines surveyed.
Battery of tests to validate the best practice.
Recommendations for installation including manufacturers input

Duration
9 months

Potential for application
High

Requirement for technology transfer
Clear, illustrated handbook

Special skills required from project team
Tendon support and installation of support knowledge
Writing and graphic art skills to communicate ideas simply and clearly

GOLD AND PLATINUM MINING

Project reference number: GAP 701

Project title
Risk assessment of hoisting with and without a safety detaching hook

Motivation for project
The incident at a mine where a shaft accident caused a load to hit a scissor plate asymmetrically thereby causing the opening of the detaching hook has sparked a debate on the whole concept of the detaching hook. Tests in the UK have proven the susceptibility of the hook to open if struck by a sufficient force on any one outer lug of the scissor plate (refer Project GAP 340: Investigation into the opening behaviour of mine shaft detaching hooks). Modifications to make it safer have been effected and tested, but this does not eliminate the risk entirely.

This proposal aims at assessing the inherent risks associated with hoisting with or without the detaching hook. Koepe winder operations and incline winders do not use this concept. Has the need for this been superseded by the modern day elaborate overwind/underwind electro-magnetic and electronic devices? Are jack-catches an adequate "fall-back" protection if all else fails to stop an overwind situation? These are some of the questions that need to be answered before an informed decision can be taken on the future of the safety detaching hook.

Primary output
A document that will clearly state the risks associated with hoisting:
1. With a safety detaching hook
2. Without a safety detaching hook
3. Give a recommended route to follow.

Scope
1. The study of current protection mechanisms and the assessment of each as to the adequacy in replacing the detaching hook.
2. An evaluation of the above
3. A risk analysis of each scenario
4. Recommend best practice

Duration
9 months (9 work-months)

Potential for application
Can be readily implemented depending on the outcome

Requirement for technology transfer
A recommendation for technology transfer to the mining industry, including a project launch at the end of the project.

Special skills required from project team
Mine winder maintenance and installation experience at a high technical level.

Project reference number: GAP 702

PROJECT TITLE
Develop tele-controls for self-thrusting percussion drilling machine and associated interface

Motivation
Noise hazards are becoming very prominent in the mining industry. Until such time as quieter rigs have been developed and proven, other alternative ways of reducing noise remain important. To this end a self-thrusting percussion drilling machine enables an operator to be positioned away from the hazardous and noisy area. The problem of tele-control of such machine becomes important.

A stand-off control system which includes an electro-hydraulic or electro-pneumatic interface and a power supply consisting of an electric generator which operates on the hydraulic/pneumatic line and a rechargeable battery is proposed.

Primary outputs
A prototype stand-off control for the self-thrusting percussion drilling machine, incorporating throttle positions for collaring, full-on and drill retract

Scope
1. Conduct literature survey to determine the best technology available
2. A study of these leading into the adaptation for trials on a prototype of the appropriate technology
3. Infra red and pneumatic/mechanical controls interface
4. A cost estimation for retrofitting the system on to existing machines
5. Liaise with GAP 642 ('Design and development of a quiet, self-thrusting blast hole drilling system') researcher, and refer to Final Report for GEN 420 ('An examination of methods whereby noise levels in current and new mining equipment may be reduced')
6. State clearly which parts of machine are affected and which are not.

Duration
12 months (12 work-months)

Potential for application
Potential good for Gold and Platinum mines. Encouragement may be required through the DME.

Requirement for technology transfer
Cooperation with mining industry and major suppliers

Special skills required from project team
Mining, mechanical and electronic engineering

Project reference number: GAP 703

Project title
Investigate coupling systems and designs currently in use in the gold and platinum sector. Recommend a specification for a coupling system for rail-bound vehicles.

Motivation
One of the findings of SIMRAC Project GAP 520 ('Investigate safety of rail vehicles and systems operating in South African gold mines') was that about 20% of accidents involving locomotives and rolling stock were during coupling and de-coupling operations. In most cases a limb is squashed between the buffers of the units being coupled/de-coupled. This proportion could be reduced if these operations could be either automated, or a safer coupling procedure could be adapted. There are a variety of coupling systems in use in the mines, some of them safe and others relatively unsafe. This proposal aims to investigate all coupling designs and procedures, and to recommend a safer coupling system for the industry.

Primary outputs
1. Provide technical specification for the best design for couplings for safety
2. Best practice in coupling/de-coupling procedure

Scope
1. Investigate the systems in current use
2. Investigate the appropriateness of current designs and procedures.
3. Explore new coupling systems, particularly those that remove limbs from between the buffers
4. The investigation to cover at least 10 mines and a good spread of machine types
5. Recommend best design and procedure for safety

Duration
3 months (3 work-months)

Potential for application
Potential for application of the appropriate recommendation is high as the costs for any modification is likely to be low.

Requirement for technology transfer
Apart from a comprehensive report, a project launch should be held with stake holders

Special skills required from project team
Mechanical engineering (on mine experience) and Ergonomics experts will be essential.

Project reference number: GAP 704

Project title
The ergonomics of locomotive design in the South African mines

Motivation
Locomotives and rolling stock account for about 8 deaths and about 160 injuries per annum in the gold and platinum sector. (Based on SAMRASS data 1994-8 for the rate, and 1998 labour complements). Some research has been done to try and establish the reasons for accidents in these machines. GAP 520 ('Investigate safety of rail vehicles and systems operating in South African gold mines') was quite exhaustive in categorising and ranking of the problem areas. It is estimated that about 85% of the accidents are due to human beings failing to comply with safety procedures. The report also highlighted areas of the design of the locomotives which are arguably contributory to accidents. These include the cab, the driver's position relative to the leading car the controls and many other areas.

This proposal seeks a dispassionate study of the existing machines and an assessment of the machines against the ergonomics requirements for safer operation or use.

Primary outputs
1. A concise report of best machine design for the industry
2. A practical strategy for the improvement of the current fleet

Scope
1. Assess locomotives and rolling stock design for safety, i.e. visibility, lighting, driver position in relation to the whole train and visibility (colour).
2. Conduct an international survey and compare the designs used elsewhere with our designs.
3. Evaluate above and give a concise and practical recommendation on best design for safety
4. Outputs of GAP 520 ('Investigate safety of rail vehicles and systems operating in South African gold mines'), GAP 635 ('Performance requirements for locomotive braking systems') and GEN 604 ('A strategy for the transfer of health and safety technologies in the South African Mining Industry') to be considered
5. Liaison with major manufacturers is advised

Duration
12 months (12 work-months)

Potential for application
Potential for application will be determined by the financial implications

Requirement for technology transfer
Apart from a comprehensive report, a project launch should be held with stake holders

Special skills required from project team
Mechanical engineering and Ergonomics experts will be essential.

Project reference number: GAP 705

Project title
Investigate the feasibility of a mine-wide continuous closure monitoring system for gold mines at a variety of depths.

Motivation
The continuous closure measurements conducted for projects GAP332 ('Deep gold mine fracture zone behaviour') and GAP 601 ('Experimental and theoretical investigations of fundamental processes in mining induced fracturing and rock instability close to excavations') have indicated that these measurements show promise to assist with:

- support design (e.g. to estimate how closure rate is affected by mining rate)
- identify different geotechnical areas
- assess the effectiveness of preconditioning
- identify areas that should be preconditioned
- identify areas with a high risk of falls of ground
- estimate face stresses and determine the risk of face bursting

Some of these concepts will be further investigated in GAP 601 over the next two years. This research will eventually form the basis of a continuous real-time closure monitoring system on a mine-wide basis (analogous to the existing seismic networks). The problems associated with such as system will however be:
Unlike the geophones of seismic system, the closure transducers cannot remain in a fixed position and will have to be moved or new ones added on a regular basis.
The distance from the transducers to the faces will have to be monitored on a regular basis.
Compared to the existing seismic networks, there will therefore be more practical problems associated with such a system. The proposed project should investigate these problems and determine the feasibility of a mine-wide continuous closure system.
The instrumentation will be an added expense to the mine but there will be significant cost benefits to the mine as safety is enhanced.

Primary outputs
A report describing the feasibility of a mine-wide real-time continuous closure system.
Estimated cost benefit in terms of safety of such a monitoring system.

Scope
The work will focus on possible closure transducers and different methods of data retrieval. Requirements such as density of transducers and optimum locations will also be investigated.

Duration
12 months

Potential impact for application
Assured

Requirement for technology transfer
The initial phase of technology transfer will focus on publications and seminars. As wider acceptance of the concept is achieved, industry workshops might prove valuable.

Special skills required from project team
Previous experience of continuous stope closure monitoring. Expertise in different closure measurement techniques and the analysis of continuous closure data from different geotechnical areas are also required.

Project reference number: GAP 706

Project title
Pre-feasibilty investigation of infrared thermography for the identification of loose hangingwall and impending falls of ground

Motivation
Falls of ground are a major source of accidents in South African mines. The identification of impending falls of ground would enable of early warning and thereby reduce the risk of accidents.
Loose rocks usually have a lower temperature than solid, undisturbed rock. This temperature gradient depends very much on how separate rocks are from the rock mass, their thermal conductivity and ventilation conditions, and to a lesser extent, on the type of rocks. Such gradient could be anywhere from 0,1 C to a few degrees centigrade.
Infrared (IR) thermography which provides visualisation of temperature gradients could be used for identification of underground hazards.
This technique has potential to be used to identify dynamic failure of the rock in pillars and faces.

Primary outputs
A comprehensive report on the possible use of the infrared (IR) thermography for identification of loose hanging wall in South African mines and recommendations on the implementation of the method.

Scope
Comprehensive international literature review on the use of IR technology in determining fractures and openings in materials and particularly in rocks.
Establishing the influence of the hanging wall and roof conditions, environmental and ventilation parameters on the rock temperature gradient. Identification of the available devices applicable for underground use.

Duration
3 months

Potential for application
High

Requirement for technology transfer
Co-operation with the mining industry

Special skills required from project team
Electronic, optical, geophysical and environmental engineering.

Project reference number: GAP 707

Project title
Understanding and determining the variability of the primitive stress environment using the new stress measuring technique developed by SIMRAC to obtain additional measurements.

Motivation
Many mine designs are undertaken on scant geotechnical information and particularly incomplete stress data. A relatively few stress measurements have been performed in the South African mines and it is assumed that there is a predictable trend in stress with depth. However, the database does show a large amount of scatter of the data. This may be connected to geological anomalies. It is critical to gain insights into the reasons for the variability of stress readings and where to carryout stress readings to best characterise the stress environment with the least readings. Improved stress environment knowledge will result in better mine layouts, more stable excavations and safer conditions in general.

Primary outputs
1. Factors that influence stress variation
2. Suggested methodology for establishing a stress environment cost effectively, including the recommended number of measurements and positions of those measurements relative to geological features.
3. A set of new stress measurements from a variety of underground situations.

Scope
1. Literature survey of the expected stress regime in different geological conditions and the zone of influence of anomalous conditions.
2. Program of stress measurements representative of a number of underground geological and mining conditions.

DURATION
24 months

Potential for application
High

Requirement for technology transfer
Booklet of layout of stress mining site.

Special skills required from project team
Structural Geology
Rock engineering

Project reference number: GAP 708

Project title
The design and development of an effective support system for tabular stopes in gold and platinum mines.

Motivation
SIMRAC has funded a large number of rock engineering related projects during the past six years which have resulted in improvements in support and mine layout and better understanding of mining induced rock response of different geotechnical areas. Despite these efforts, fall of ground accidents in the vicinity of the stope face continue to represent the major safety hazard in gold and platinum mines, during day and night shifts. Although support design has been identified as the major research thrust in rock engineering for the next three years, it is unlikely that improvements in conventional systems will result in a significant improvement in accident rates. It is therefore imperative that alternative solutions be explored.

Primary outputs

Phase 1 (Feasibility Study)
1. Specifications and operational criteria for an effective stope support system, during all phases of production including blasting and cleaning cycles during day and night shift.
2 Generation and evaluation of concepts of new alternative systems.
3 Recommendations and action plan for the detailed design, manufacture and testing of a prototype of the preferred system (as detailed in Phase 2)

Phase 2 (Prototype System)
1 Detailed design of the system and its components
2 Construction of a experimental scaled model to assess operational and practicability
3 Verification of the performance of the concept system using computer simulation
4 Production of a prototype system
5 Evaluation of the system in laboratory conditions under varying conditions
6 Assessment of performance in an underground testing site
7 Recommendations and action plan for the introduction of the system on an industry scale
8 A comprehensive report on the project (including drawings, technology transfer, performance data, etc.)

Scope
1 Conceptual, experimental, design, prototype and testing phases must be followed
2 Scanning, identifying and evaluation of a wide spectrum of suitable technologies, contributors and strategic alliances
3 Must cater for typical conditions in hard rock tabular excavations under rockfall and rockburst conditions during all phases of mining(day and nightshift).
4 New, innovative and novel alternatives and technologies must be investigated and pursued
5 A multi-disciplinary approach and participation must be pursued
6 Patenting and licensing on behalf of the Mine Health and Safety Council

Duration
Phase 1: 6 months
Phase 2: 30 months

POTENTIAL for application
High potential impact but high research risk

Requirement for technology transfer
Details of specifications, performance and manufacture (for manufacturers)
Project launch (for rock engineers, etc)
User-friendly booklet, video and demonstration (to end-users)

Special skills and facilities required by project team
- Expert rock engineering input
- Proven equipment design capability and capacity
- Access to laboratory and testing facilities

Project reference number: GAP 709

Project title
The meaningful use of peak particle velocities at excavation surfaces for the optimisation of the rockburst support criteria for tunnels and stopes.

Motivation
At present, rockburst prone mines generally make use of a 3 m/s velocity criterion to design rockburst resistant support systems. However, recent work has shown that the potential exists to reduce the 3 m/s criterion under certain circumstances, without compromising the rock mass integrity or increasing the rockburst hazard. Although work in site response has been conducted in two previous SIMRAC projects viz. GAP 201 and GAP 530('Improvement of worker safety through the investigation of the site response to rockbursts'), limited success has been achieved in measuring large PPVs. A field experiment conducted in GAP 530 assisted in simulating a rockburst in a tunnel and a similar experiment in a stope would assist in advancing the understanding of the effects of seismicity and rockbursts in stopes.
The research should further aim to evaluate systematically the peak particle velocity variations over a large number of underground areas, on and off reef, and to improve the velocity criterion, thereby optimising rockburst support systems and increasing worker safety.
An instrument for measuring a large number of PPVs in a cost effective manner is necessary to the success of this project.

Primary outputs
A report detailing the following:
1. enlarged database of measured PPVs in stopes and tunnels in various geotechnical areas and support behaviour in these situations.
2. back-analyses (using data collated over the last 10 years) of mine network data to derive the velocity amplification factors on the skin of the excavations and to derive the scaling equations between the PPVs measured in the stope or tunnel vicinity and the PPVs measured by the mine network
3. application of an advanced statistical procedure to estimate the probability of the occurrence of a particular PPV
4. guidelines for optimum rockburst support criteria for stopes and tunnels
5. report from an underground stope experiment in which a rockburst is simulated
6. development of an instrument which can be attached to a variety of support units to measure PPVs. The cost of the instrument will enable the wide deployment of the instrument.

Scope
1. Extensive in-stope and tunnel underground measurements of peak particle velocities for various geotechnical areas.
2. Back-analyses (using data collated over the last 10 years) of mine network data to derive the velocity amplification factors on the skin of the excavations and to derive the scaling equations between the PPVs measured in the stope vicinity and the PPVs measured by the mine network.
3. Quantification of the peak particle velocities and support behaviour for different geotechnical conditions.
4. Application of an advanced statistical procedure to estimate the probability of the occurrence of a particular PPV.
5. Guidelines for optimum rockburst support criteria.
6. Simulate a rockburst in a stope and measure the effects of the event on rock and support units in the critical areas of the stope.
7. Development of a simple device to measure PPV's.

Duration
24 months

Potential for application
Assured

Requirement for technology transfer
Industry workshops
Publications (reports, papers, seminar and conference proceedings)
Improved rockburst support design methodology

Project will produce guidelines for optimal support design and for the best development method by considering the applicability of rockburst control techniques. The guidelines derived as a result of various case examples must be communicated to the industry via seminars.
Intrinsically safe device which can be easily installed underground and data downloaded after a monitoring period.

Special skills required from project team
Seismological expertise with a strong background in analysis of peak particle velocities
Knowledge of the previous work conducted by SIMRAC and Deepmine in this field of research
Understanding of the support methodologies used in the South African gold mines
Numerical modeling skills and familiarity with statistical analyses techniques
Skills and experience with specialised underground equipment
Electronic and software engineering skills.

Project reference number: GAP 710

Project title
Underground verification of the large deflection performance of fibre reinforced shotcrete subjected to high stresses and convergence and to dynamic loading.

Motivation
Fibre reinforced shotcrete is being used widely in the industry at present. At present SIMRAC project GAP 616 ('Determine the effect of repeated dynamic loading on tunnel support performance and produce recommendations for improved design criteria') is studying membranes as part of a support system for tunnels under repeated dynamic loading. A Deep Mine project has looked at fibre shotcrete testing in the laboratory. However, an investigation into the use of fibre shotcrete underground and its performance in this environment is required.

Primary outputs of project
Report on the efficiency of different shotcrete types underground during quasi-static and dynamic condition, which result in large deflections.

Scope
1. Underground survey of mines using fibre shotcrete.
2. Document individual sites
3. Instrument sites
4. Refer to Deepmine Project and SIMGAP Project GAP 616

Duration
12 months

Potential for application
High

Requirement for technology transfer
Workshops and results
Booklet documenting results

Special skills required from project team
Underground experience
Geotechnical knowledge

GENERIC

Project reference number: GEN 701

Project title
Survey of best practice in respect of the design, installation, maintenance and operation of conveyer belt systems

Motivation
To identify world best practice in respect of design, installation and operation of conveyer belt systems

Primary outputs
1. Occupational Health and Safety Hazard Identification and Risk Assessment in respect of installation and operation of conveyor belt systems
2. Survey of best practice, internationally benchmarked to address the significant OH&S risks identified through output 1

Scope
1. Cover different types of conveyor belt systems, including man-riding
2. Cover both mining (excavation) and extraction (beneficiation) processes, and
3. Cover underground, surface and inclined applications

Duration
12 months (12 work-months)

Potential for application
Very extensive. Covers Gold; Platinum, Coal and Other Mining categories, beneficiation and underground and surface applications.

Requirement for technology transfer
Include recommendations regarding transfer of technology to the mining industry

Special skills required from project team
1. Competence in field of conveyer systems
2. Competence in respect of OH&S HIRA - to identify significant risks
3. To consult OTH 202 ('Investigate the causes of transport and tramming accidents on mines other than coal, gold and platinum') researchers

Project reference number: GEN 702

Project title
The criteria for the safe use of commercial personnel transportation of personnel in the underground environment

Motivation
The use of commercial vehicles (some of them flame proofed and some not, at collieries) is gathering momentum. The individual user may currently apply for an exemption to use a certain make of vehicle. Exemption would of course be granted on the merits of each application. Some users improvise and retrofit some form of a drive-line brake system. Others use the vehicles exactly as supplied by the dealer. It is not clear whether these vehicles are regulated as specified in SABS 1589 (*The braking performance of trackless underground mining vehicles - Load haul dumpers and dump trucks).* If not, what are the safety risks involved in the use of standard vehicles underground?

Flame proofing is specified in SABS 868-1 & 2. There is a growing empirical inference that perhaps the lack of it will not necessarily compromise safety. There is a need to investigate these issues and provide mine managers with some guideline as to the safety risks involved in the use of these vehicles under different conditions. This will assist the manager to make an informed decision where necessary.

Primary outputs
Criteria for the use of commercial vehicles for the transportation of personnel, under the following conditions:
1. Fiery collieries
2. Mines susceptible to gaseous explosions
3. Travelling up and down ramps

Scope
1. Investigate the extent to which commercial vehicles are used underground for transporting personnel
2. Highlight any recorded incidences/accidents involving these vehicles in all mining sectors where they are used.
3. Compile criteria for their safe use under the respective circumstances

Duration
4 months (4 work-months)

Potential for application
All South African mines that use these vehicles.

Requirement for technology transfer
Suitable recommendations for effective transfer of technology to the mining industry.

Special skills required from project team
Mechanical and electrical and mining engineering experience in South Africa.

Project reference number: GEN 703 (Coal & other mines)

Project title
Methodology for the safe cleaning and making safe of various height (10m - 35m) highwalls

Motivation
Increased incidence of fatal and other accidents from highwall failures on opencast mines.
All opencast collieries and possibly other mines such as quarries

Primary outputs
Methods of cleaning to create safer highwalls and other methods of making highwalls safe

Scope
Investigate and report on methods of making highwalls safe. Various heights of highwall should be investigated, from 10 - 35m.

Duration
12 months

Potential for application
High
Safer highwall conditions leading to a reduction in accidents/incidents

Requirement for technology transfer
A clear, concise report accompanied by a well illustrated booklet demonstrating the best practice and highlighting the possible dangers of highwalling.
Workshops on mines which practice highwalling

Special skills required from project team
Opencast mining experts – preferably collieries. Rock Engineering knowledge

Project reference number: GEN 704

Project title
Develop a non-destructive testing method for establishing the integrity of roof bolts/rock reinforcing units

Motivation
The proper installation and maintenance of roof-bolts is a critical operation to prevent falls of ground. Currently no reliable in-situ test methods are available to determine the actual length of a bolt, or the strength of the bond between the bolt and the rock. It is necessary to investigate the feasibility of a portable, in-situ testing device that can be used to determine the integrity of installed roof-bolts.

Primary outputs
1. An experimentally validated mathematical model of roof-bolts installed in a rock face.
2. An in-situ testing procedure to determine the integrity of installed roof-bolts
3. Experimental demonstration that can be used to validate the concept experimentally.
4. Underground evaluation of the proposed system.
5. Report documenting the results.

Scope
All underground mining operations making use of roof-bolts, both soft and hard rock mines.

Duration
12 months

Potential for application
Medium

Requirement for technology transfer
Simple, low cost, easy to use, handheld, intrinsically safe instrument that indicates the quality of a roof bolt installation with a high probability of success

Special skills required from project team
Instrumentation, monitoring, metallurgy, knowledge of support types and installation techniques

Project reference number: GEN 705

Project title
Ranging open path remote flammable gas detection/monitoring device

Motivation
During the course of the Project COL 601 ('Remote flammable gas detection/monitoring device') it has been established that:

1. Since the open path remote gas sensor provides only the true integrated (averaged) concentration of flammable gases per meter along the path it does not detect areas where a dangerous level of methane is building up.
2. From the point of view of safety and the current Regulation requirements, such a measurement is inadequate for safety and could even be dangerous.

As an example, the integrated methane concentration of 1,0 percent per meter has been measured at a distance of 12 m from the coal face. This is still a permissible level. In reality, the point concentration of methane at the face could achieve as much as, for example, 5,0 per cent or even more. There is no way that the point methane concentration measurement which is required by Regulation could be achieved by using this technology.

Measuring methane concentration in a sealed area seems to be the only possible application of the open path remote methane detector. The reason for this is that there is no air movement in sealed areas and methane and air mixture is relatively homogeneous. Therefore, integrated measurement in methane concentration per meter will correspond to the point concentration measurement. In order to implement the method a transparent window should be provided in the seal. Measuring the methane level in the sealed area requires simply sending the Infra-red beam through the window and taking a reading.

In order to use open path remote flammable gas sensing it is proposed that the *time sampling or ranging open path remote sensing* methodology be developed. This is a more sophisticated technology enabling the distribution of methane concentration along the open path to be obtained. This in turn enables the Regulation requirements for routine methane monitoring and early warning to be met.

This technology depends on the beam reflected/propagated off fine dust or moisture particles and therefore does not necessarily require special reflectors to be installed. It can also reflect off the pillar/face of a coal mine. The distance through which measurement is potentially possible depends on the quality of the atmosphere; the dirtier it is, the further the instrument can measure. Measurements can only be obtained on the line of propagation. Layering measurements may be obtained by adjusting the height of the propagation aperture, or by pointing the beam in a vertical direction (where practicable).

Primary outputs
Laboratory prototype of the device

Scope

1. Optical properties of the coal face and roads.
2. Propagation of 3,31 □m radiation in collieries.
3. Design and development of a light detection and ranging device.
4. Processing the obtained information on the atmosphere attenuation.
5. Calibration of measuring instruments.

Duration
24 months

Potential for application
This instrument will be readily used by all mines.

Requirement for technology transfer
Suitable recommendations to enhance the transfer of technology to the industry. A project launch must be done at the end of the project.

Special skills required from project team
Optical, electronic, mechanical and environmental engineering, occupational health and instrumentation expertise essential.

OCCUPATIONAL HEALTH

Project reference number: HEALTH 701

Project title
Recommendations on the provision of preventive therapy against tuberculosis for South African mineworkers

Motivation
South African mineworkers currently experience rates of tuberculosis that are among the highest in the world. The link between silicosis and tuberculosis is well recognised as an occupational health priority. In addition, the Human Immunodeficiency Virus (HIV) epidemic is worsening the already serious problem of tuberculosis. Preventive therapy against tuberculosis has been shown to be effective among high risk individuals including those with silicosis and HIV infected individuals, and is recommended by the World Health Organisation (WHO) and Centres for Disease Control (CDC). The cost-effectiveness of preventive therapy should be evaluated as part of a comprehensive strategy to control tuberculosis in the South African mining industry.

Primary outputs
1. Evaluation of the cost-effectiveness of preventive therapy regimens and modes of administration against tuberculosis; and
2. Identification of best practice for the mining industry.

Scope
Preventive therapy for high risk individuals should consist of at least six-months of isoniazid, as prophylaxis against tuberculosis. A novei approach to determine efficacy of preventive therapy regimens should include intervention and long-term (2 year) follow-up of at least 3 cohorts (6 months, 1year, 2 years of treatment) to identify best practice for high risk workers in the mining industry. Variables used in the economic evaluation should include outcomes such as TB incidence, hospital admission, work absenteeism, compensation claims and mortality.

Duration
48 work-months

Potential for application
High impact: Results will enable the mining industry to evaluate the cost -implications of introducing preventive therapy for high risk individuals.

Special skills required from project team
- Epidemiology and statistical skills
- Experience in the diagnosis and treatment of tuberculosis
- Counselling skills
- Laboratory (quality assured sputum smear and culture as well as HIV status)
- Health economics expertise

Project reference number: HEALTH 702

Project title
A prospective study to assess the incidence and work-related risk factors in the development of musculoskeletal disorders in the South African mining industry.

Motivation
International experience indicates that work-related musculoskeletal disorders (WMSDs) are among the most prevalent lost-time injuries and illnesses in almost every industry, including mining. Workplace risk factors are main contributors to the development of WMSDs. Several mining tasks in an aging workforce on South African mines are associated with strenuous physical activities performed in awkward body postures within restricted workspaces. In addition, miners are exposed to vibration from various sources. Although WMSDs should occur frequently among miners, the exact extent of the problem, if present, is unknown.

Primary outputs
- Record review of musculoskeletal disease and injuries to assess the incidence and possible workplace risk factors
- Development of a data collection tool to collect relevant WMSD information in the mining industry
- Prospective study on the occurrence of WMSDs in the South African platinum, gold and coal mining industries.
- An assessment of work-related factors that may pose a risk of WMSDs and recommendations to alleviate them.

Scope
Record review of injuries and symptoms normally classified as WMSDs and associated occupational data will assist in development of the data collection tool for the prospective study. The prospective collection of data on WMSDs from primary care consultations and injuries recorded on mines will be conducted on gold, platinum and coal mines selected to include the full range of mining methods and working conditions. Tasks of high risk occupations will be analysed to identify ergonomic risk factors that may contribute to the cause of the symptoms or disorders. Possible ergonomic interventions to reduce the risk will be considered.

Duration
24 months (48 work-months)

Potential for application
High Impact: Assessment of the frequency of WMSDs and the identification of high risk exposures or mining tasks would provide valuable baseline data for ergonomic intervention to reduce and eliminate such disorders.

Special skills required from project team
- Occupational Medicine with expertise in diagnosing musculoskeletal disorders
- Ergonomics and work physiology
- Epidemiology

Project reference number: HEALTH 703

Project title
The occurrence of hand arm vibration syndrome (HAVS) in South African gold mines and identification of the potential effects of whole-body vibration (WBV)

Motivation
The potential risk for the development of HAVS through rock drilling in the mining industry was highlighted by a SIMRAC report on the vibration characteristics of mining equipment (GEN 503). This report recommended a study to determine the prevalence of HAVS in miners. HAVS has been reported in miners from many countries and is compensable in South Africa (COID Act Schedule 3 of 1993), as well as in other countries such as the UK. No cases have yet been documented in South Africa miners. Patients from other industries with clinical symptoms similar to HAVS have been seen at the NCOH Clinic, raising the suspicion that the prevalence of HAVS in mining may be similar to other countries but it is not diagnosed or reported. In addition to HAVS, WBV is equally insidious and, in addition to a prevalence study on HAVS, the project should be extended to an assessment of the potential for WBV effects and their detection. The project should ideally consist of two stages, i.e. HAVS (Phase 1) and WBV (Phase 2).

Primary outputs
A two-phased project:

Phase 1: HAVS: To determine the prevalence of HAVS in miners. To assess the clinical severity of the condition. To assess the association of HAVS with the use of specific types of equipment.

Phase 2: WBV: To identify the need for and formulate further research on whole-body vibration. To develop a database for monitoring of vibration induced trauma.

Scope
Survey of miners at risk, due to the use of hand held vibrating tools. Literature review of whole-body vibration and the development of sensitive databases to enable monitoring of vibration-induced trauma.

Duration
18 months (36 work-months)

Potential for application
High impact. Would result in the assessment of a well-documented occupational disorder which has not been recognised in South African miners.

Requirement for technology transfer
Report, guidelines and monitoring protocols for use of database

Special skills required from project team
Diagnostic skills and equipment
Ergonomic expertise

Project reference number: HEALTH 704

Project title
Direct (real-time) estimation of occupational dust exposure

Motivation
In order to quantify the true nature of occupational dust exposure, real-time measurements are needed. Present instruments have well-defined limitations. An alternative method of measurement, using existing or modified instruments, is necessary in order to establish more precise dose-response relationships in a cost-effective manner. The current proposal is based on the recommendations emanating from SIMRAC Project GEN 417.

Primary outputs
1. Evaluation of currently used direct reading instruments and the nature of occupational dust exposure
2. Analysis of success/failure/cost of identified instruments (cost function relationship).
3. Development of revised measurement method to estimate occupational (real-time) exposures.

Scope
Scientific evaluation of existing dust measuring instruments and methods under controlled (simulated) underground and surface environments. SIMRAC Project GEN 417 ('Dust sampling for engineering control purposes') should form the basis of the proposal.

Duration
12 months (24 work-months)

Potential for application
Assured, provided the methodology can be refined. Basis for future aetiology and revisions of OELs and improved dust control.

Requirement for technology transfer
Seminars/workshops and compendium of best practices

Special skills required from project team
Accredited dust laboratories
Sound scientific research skills
Expertise in dust measurements/instrumentation
Mine ventilation expertise and experience
Workshops for instrument testing and modification

SIMRAC PROJECT NO. _____

MEMORANDUM OF AGREEMENT ENTERED INTO BY AND BETWEEN :

THE DEPARTMENT OF MINERALS AND ENERGY
(hereinafter referred to as "the DEPARTMENT")
for the execution of a Project under the aegis of the MINE HEALTH AND SAFETY COUNCIL through its permanent committee the SAFETY IN MINES RESEARCH ADVISORY COMMITTEE ("SIMRAC") herein represented by THE CHIEF INSPECTOR OF MINES duly authorised thereto

AND

_____
IDENTITY/REGISTRATION No.: _____

hereby represented by

_____
IDENTITY No.: _____
duly authorised thereto

(hereinafter referred to as "the CONTRACTOR")

WHEREAS the contractor herewith submits to the Department the Project Proposal ("the PROPOSAL"), of which the original is initialled and attached marked SCHEDULE A hereto, to be executed under the aegis of SIMRAC;

NOW THEREFORE THE PARTIES AGREE AS FOLLOWS:

1. The terms and conditions set out herein apply to the Proposal, and the Proposal, dated _____ and entitled _____ forms part of the agreement.

2. The persons signing the Proposal on behalf of their respective principals, warrant their authority. (Attach resolution of authorisation, if the contractor is not a natural person.)

3. Before the Contractor commences work on the project, he must inform SIMRAC timeously of the date on which he/she proposes to start work and provide details of the Project Schedule, and (if applicable) provide details of any proposed changes in the initial Project Schedule submitted.

4. The contract price shall be paid as follows:

Projects which extend over a period of up to three months

- Payment for Projects which extend over a period of up to three months will be negotiable. All payments will be subject to acceptance by SIMRAC of progress reports. Thirty per cent of the total contract amount will be retained until acceptance by SIMRAC of all project deliverables.

Projects which extend over a period of up to one year

- Ten per cent of the total contract amount on the commencement date

- Fifteen per cent of the total contract amount upon receipt of the Final Report
- Fifteen per cent of the total contract amount on acceptance by the Chief Inspector of all Project deliverables
- The remainder of moneys will be paid in equal amounts, at quarterly intervals of the Project duration, upon acceptance by SIMRAC of progress reports as referred to in Clause 10 hereof

Payment schedule (10%--15%--15%--15%--15%--15%--15%)

Projects which extend over a period of longer than one year

The annual contract amount shall be paid over the duration of the Project as follows:

Year 1:

- Ten per cent of the total annual contract amount on the commencement date
- The remainder of the total annual contract amount will be paid in equal quarterly amounts upon acceptance by SIMRAC of progress reports as referred to in Clause 10 hereof

Payment schedule: (10%--22.5%--22.5%--22.5%--22.5%)

Final year:

- Seventy per cent of the total annual contract amount will be paid in equal quarterly amounts, upon acceptance by SIMRAC of progress reports as referred to in Clause 10 hereof
- Fifteen per cent of the total annual contract amount on receipt of the Final Report
- Fifteen per cent of the total annual contract amount on acceptance by SIMRAC of all Project deliverables

Payment schedule: (17.5%--17.5%--17.5%--17.5%--15%--15%)

Any other year (If applicable)

- The total annual contract amount will be paid in equal quarterly amounts upon acceptance by the Chief Inspector of progress reports as referred to in Clause 11 hereof

Payment schedule (25%--25%--25%--25%)

Payments will only be made by the Department against the submission to the Department of detailed invoices by the Contractor and on verification and approval thereof by SIMRAC.

5. The Department shall effect payment in respect of invoices submitted in terms of Clause 4 within 14 days of approval by SIMRAC of the quarterly progress reports and financial statements referred to in Clause 4 hereof. SIMRAC shall inform the CONTRACTOR if payment has not been approved and shall supply reasons therefore.

6. The Contractor shall maintain a complete set of accounts relating to the contract, which shall include full details of all disbursements made in connection with the contract and worksheets recording details of all man-hours charged to the contract. All such documentation shall be made available for inspection on request during normal business hours to authorised representatives of the Department and/or SIMRAC, and shall be summarised in financial statements accompanying quarterly and final project reports.

7. In the event of the total cost of the project exceeding the contract price the Department shall not be responsible for any excess.

8. Where project proposals are submitted by persons, agencies or sub-contractors domiciled outside the Southern Africa Common Monetary Area, all monetary amounts recorded in financial statements and progress reports must be expressed in both the foreign currency and its equivalence in South African Rand. All payments shall be made in South African Rand and the Department will not be responsible for changes in costs attributable to changes in exchange rates or other external factors and the Contractor shall without limiting the generality hereof be liable for any costs of forward cover.

9. Within 2 (two) weeks of the end of each successive quarter the Contractor shall submit to SIMRAC a quarterly progress report recording work completed on, and progress with, the project in the preceding quarter, providing sufficient detail to allow a quantitative assessment by SIMRAC of actual progress made by the Contractor. Each such quarterly report must be accompanied by a financial statement detailing all expenditures and costs incurred in connection with the project in the preceding quarter. SIMRAC may specify the format of the reports, and the Contractor shall submit his reports in the specified form.

10. Within 6 (six) weeks of the completion of the project the Contractor shall submit a final project report, containing an overall review of the project and conclusions based on the entire project, to the Department for consideration by SIMRAC; such final report must be accompanied by a comprehensive and detailed financial statement covering the entire project, together with a copy of the project asset register referred to in Clause 18 hereof.

11. All reports, asset registers and invoices submitted to SIMRAC in terms of this contract shall where applicable comply as regards content and format with the requirements of SIMRAC as formulated from time to time.

12. At any time during the contract period, or within a reasonable period after termination of the contract, the Contractor shall on request by SIMRAC prepare a formal paper on the subject matter of the contract and provide a knowledgeable and competent speaker to present the paper, if appropriate with audio-visual aids, to an invited audience of persons employed in or associated with the South African mining industry.

13. At any time during the Contract period authorised SIMRAC representatives shall be entitled by prior arrangement with the Contractor to inspect work in progress on the project, and to request up-to-date reports on the project or on specific aspects of the project.

14. All intellectual property rights arising out of or derived from the project contemplated in the Proposal shall vest in the Department; provided that the Department may, upon written application by the Contractor and acting on the advice of SIMRAC, grant permission in writing for the said intellectual property rights to be published, utilised or exploited commercially by the Contractor or others subject to such terms and conditions as the Department may in its sole discretion specify.

15. The contractor shall on request in writing by the Department or SIMRAC make available to the Department or SIMRAC, as the case may be, all information, including but not confined to, raw data, statistical analyses, formulae, plans, photographs, internal and

external reports, and the like obtained, devised or developed by the Contractor or a sub-contractor in the course of performing the project in question, and shall furthermore assist the Department to the best of its ability if the Department should in its sole discretion apply for the registration of a patent or design based on studies undertaken in terms of the contract.

16. All physical equipment, instrumentation, and the like purchased by the Contractor for use in connection with or as part of the project, and/or charged to the Department, shall at all times remain the property of the Department; provided that the Contractor may at any time make an offer to purchase such goods for his own use and the Department, acting on the advice of SIMRAC, may sell or dispose of such goods to the Contractor or others subject to such terms and conditions as the Department may in its discretion specify.

17. The provisions contained in Clause 16 above shall also apply, subject to the necessary changes having been made, to intellectual property, such as computer programs and software, patents, and designs purchased by the Contractor for use in connection with the project.

18. All assets purchased by the Contractor in connection with or forming part of the contract and/or charged to the Department shall be recorded in a project asset register opened for each separate project by the Contractor, which shall at all relevant times be available for inspection by SIMRAC or its representative. All such assets shall be kept secure, insured and maintained in good order and condition by the Contractor until such time as a decision is made by the Department concerning the disposal of such assets.

19. Where work forming a significant part of, or in connection with, or in terms of a service agreement, the contract is to be performed by a person or agency acting as a sub-contractor to the Contractor, full details of such contractual relationship between the Contractor and the sub-contractor shall be supplied to the Department, and the sub-contractor shall be required to maintain, make available and submit financial statements to the Contractor for inclusion with the quarterly and final project reports and financial statements submitted to the Department.

20. The Contractor shall not be entitled to cede or transfer the rights in terms hereof without the written consent of the Department, and the Contractor shall not replace strategic personnel or strategic subcontractors as recorded in the Proposal without first consulting SIMRAC and amending the agreement and proposal in accordance with Clause 25 hereof.

21. The parties agree that on the default of either party the other party may call upon the defaulting party in writing to remedy the default within a reasonable time, failing which the aggrieved party shall be entitled to terminate the contract or apply for specific performance, without exercising such party's right to claim damages.

22. Disputes concerning the performance of the project shall in the first instance be referred to a referee agreed upon by the parties. If the parties fail to agree on a referee, the President of the South African Institute of Mining and Metallurgy shall be asked to nominate a referee, who shall operate as an expert outside any arbitration legislation.

23. In the event of any party incurring legal costs to enforce its rights in terms hereof, the successful party to the resolution of the dispute, shall be entitled to recover all costs on an attorney and own client scale.

24. The Proposal, the Department's letter of acceptance, and the terms and conditions set out herein shall for purposes of interpretation constitute a single contract, and replaces any other agreement relating to this project.

25. On acceptance of this agreement and the Proposal, no changes or amendments shall have any force or effect unless recorded in writing and signed by or on behalf of the parties.

26. The contract shall remain in force until such time as both parties have performed their respective obligations under the contract; provided however that the Department's rights in respect of intellectual property rights and physical assets held by or under the control of the Contractor shall not be affected by the termination of the contract.

27. While engaged in the performance of the contract the Contractor shall comply with all relevant provisions of South African common law and statute law, including but not confined to measures prescribed in the Employment Equity Act, Act No. 55 of 1998.

28. Notwithstanding Clause 27 above (compliance with SA law), the Contractor shall endeavour to promote to the best of its ability the employment of previously disadvantaged persons, and without being limited thereto, specifically by employing post graduate students, to enhance the abilities of such persons at all levels while performing the contract.

29. The Contractor herewith guarantees to the Department that the execution of the Project will be of the highest professional standards and expertise, and that any strategic or key personnel or experts named in the proposal shall at all times be committed to the proposal and the project.

30. The parties choose and herewith accept the following addresses for all purposes and notices in connection with the project and the contract -

THE DEPARTMENT:

Mineralia Building
Andries Street
Pretoria
e-mail _____
Tel no. _____
Fax no _____

Private Bag X59
Pretoria
0001

THE CONTRACTOR:

_____
_____
_____
(Physical address)
e-mail _____
Tel no _____
Fax no. _____

_____
_____
_____
(Postal address)

This agreement shall commence on
Thus done and signed at on this day of **1999.**

As witnesses :

1. _____

2. _____

_____
for and on behalf of the CONTRACTOR

ACCEPTANCE OF TENDER AND CONTRACT
This contract relating to the proposal attached herewith, is hereby accepted by the Chief Inspector of Mines.

Thus done and signed at on this day of 1999.

As witnesses :

1. _____

2. _____

_____
the CHIEF INSPECTOR OF MINES

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LIVE IN HARMONY WITH NATURE
WEATHER BUREAU
WEERBURO
THE WEATHER BUREAU: DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM


THE WEATHER BUREAU HELPS FARMERS TO PLAN THEIR CROP
WEATHER BUREAU
WEERBURO
PEANUT BUTTER
COTTON
HONEY
MAIZE
WIND TOTALISATOR
SUNSHINE RECORDER
RAIN GAUGE
THE WEATHER BUREAU: DEPARTMENT OF ENVIRONMENTAL AFFAIRS & TOURISM
DIE WEERBURO: DEPARTEMENT VAN OMGEWINGSAKE EN TOERISME


KEEP YOUR SHIP GOING. PHONE THE WEATHER BUREAU FOR THE MOST ACCURATE FORECASTING
WEATHER BUREAU
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Weather balloon
WEATHER BUOY
PRESSURE-PLATE ANEMOMETER
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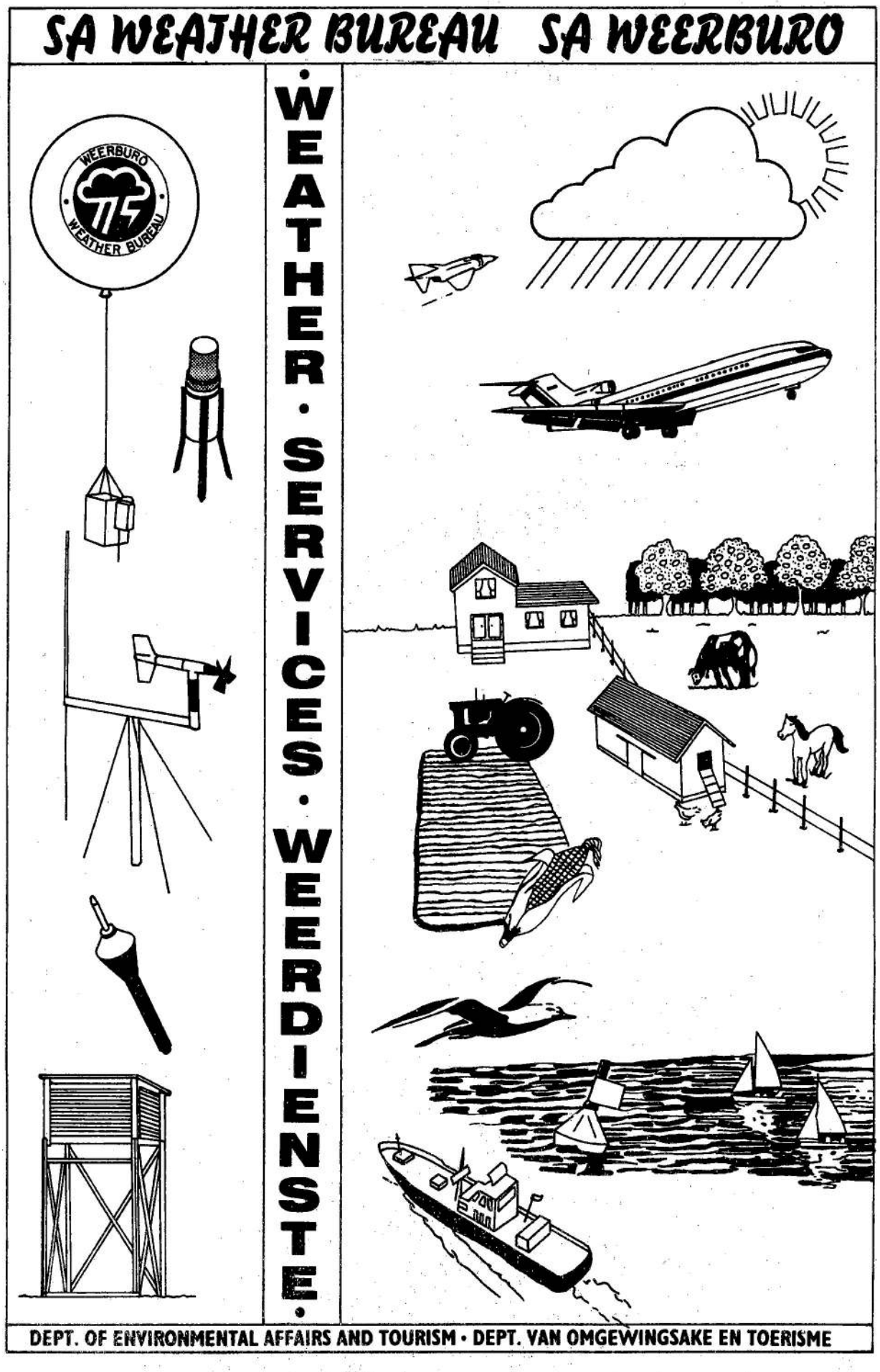
ANEMOMETER
THE WEATHER BUREAU: DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM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