target reef mining frequently occurring is a very real possibility. Any mining not perfectly compliant to the mine plan in exact three-dimensional space could be detrimental for the grade and cost profile.”

The fast, fully-mechanised production rate also makes regular up-to-date geological modelling essential.

The geological team were only able to get to grips with the complex mapping and keep up with the fast production rate by using dynamic 3D geological modelling software Leapfrog.

Says Pretorius, “Leapfrog Geo fully meets our requirements by keeping ahead of the production rate. It provides accurate, genuinely three-dimensional profiles of the individual sections that are currently being mined, based on all known geological data.”

THE PROJECT:

South Deep Gold Mine, situated in the Gauteng region of South Africa, is the second biggest and seventh deepest gold mine in the world. Its development to its present status as Gold Fields’ “flagship ore reserve” has been preceded by a history of complications punctuated by several changes of ownership. The mapping of its complex reef formations have also been a prolonged and challenging process.

Accurate geological modelling, a vital aspect of mine planning, is essential at South Deep because of the exceptional complexity of the alluvial deposit.

Says Hendrick Pretorius, South Deep’s Chief Evaluator, “In the absence of regularly updated and accurate geological modelling the risk of off-
SITUATION

The deposit comprises of 16 reef horizons in a west-to-east fan formation that is up to 130m at its thickest and highly faulted throughout. Reefs ‘pinch out’ at various points as the fan narrows towards the west.

The digital terrain 3D modelling programme used previously, while proving useful for processing and consolidating data, was unwieldy and slow.

To make analysis of the ore body more manageable for geological modelling it has been divided into segments, which have been further subdivided into smaller designated “fault blocks.”

RESPONSE

Leapfrog Geo was first introduced to South Deep in 2012. Leapfrog’s local support team provided training for the mine’s senior geological team and later the production geologists who use it day-to-day.

Not only is Leapfrog Geo more user-friendly, but it builds a model more than three times faster than the digital terrain programme. Pretorius explains, “When using the digital terrain programme a geologist cannot quite finish building a model of one fault block in a day, whereas with Leapfrog Geo he can easily build models for three complete fault blocks in a day.”

Furthermore, when an existing model requires updating with new data, using the digital terrain modelling programme it has to be completely reconfigured from scratch, whereas Leapfrog Geo updates it dynamically. Leapfrog Geo also produces a complete 3D model that more closely resembles the actual structure of any fault block.

Continues Pretorius, “Leapfrog Geo produces the fault block as a model with a volume that can be rotated to isolate individual faults within, which can be examined and analysed more closely. What’s more, all the available data can be stored with the model, which makes it more integrated, more easily accessible and more secure.”

He adds, “We’ve now reached the stage where Leapfrog Geo operates close to real time. As new information comes to hand we can instantly update the model, which provides the optimum conditions for mine planning.”

HENDRICK PRETORIOUS, South Deep’s Chief Evaluator

“...
“Leapfrog Geo is innately flexible and is able to meet the needs of a variety of geological settings. Even the complex geological modelling needs of South Deep didn’t require any special customisation”

DESMOND SUBRAMANI, Principal Geologist, Leapfrog

are less complicated also stand to benefit from adopting it. Many mines in South Africa are still using rudimentary 2D geological modelling programmes for mine planning.”

**OUTCOME**

Leapfrog Geo has enabled the latest geological data to be readily incorporated and used in South Deep’s mine planning process. This accurate and timely geological modelling provides the opportunity to increase production efficiency and reduce costs, essential in today’s challenging mining conditions.

**Benefits in brief**

**Fast** - Geologists are able to build up to three complete fault blocks in a day compared to just one with previous methods.

**Dynamic** - As new data becomes available the model is dynamically updated, previous methods required reconfiguring from scratch.

**Vision** - Modelling keeps ahead of the production rate, providing accurate, three-dimensional profiles of individual mined sections, based on all known geological data.

**Analysis** - The 3D model more accurately resembles the structure of any fault block and can be rotated to isolate particular faults for examination and analysis.

**Data store** - All available data can be stored in the software, for easier access, integration and security.

Says Desmond Subramani, Principal Geologist, Leapfrog, “Leapfrog Geo already contained the design elements capable of meeting the unique characteristics of the ore body. This amply illustrates the programme’s innate flexibility to cater to a great variety of geological settings.”

“The mining industry has been – and continues to be – severely hit by difficult economic conditions and various other disruptive factors. In such a climate it is all the more important for mining operations to ensure that costs are kept to a minimum and all opportunities to maximise profits are taken advantage of. As the South Deep example illustrates, accurate and timely geological modelling provides an opportunity to increase production efficiencies and reduce costs.”