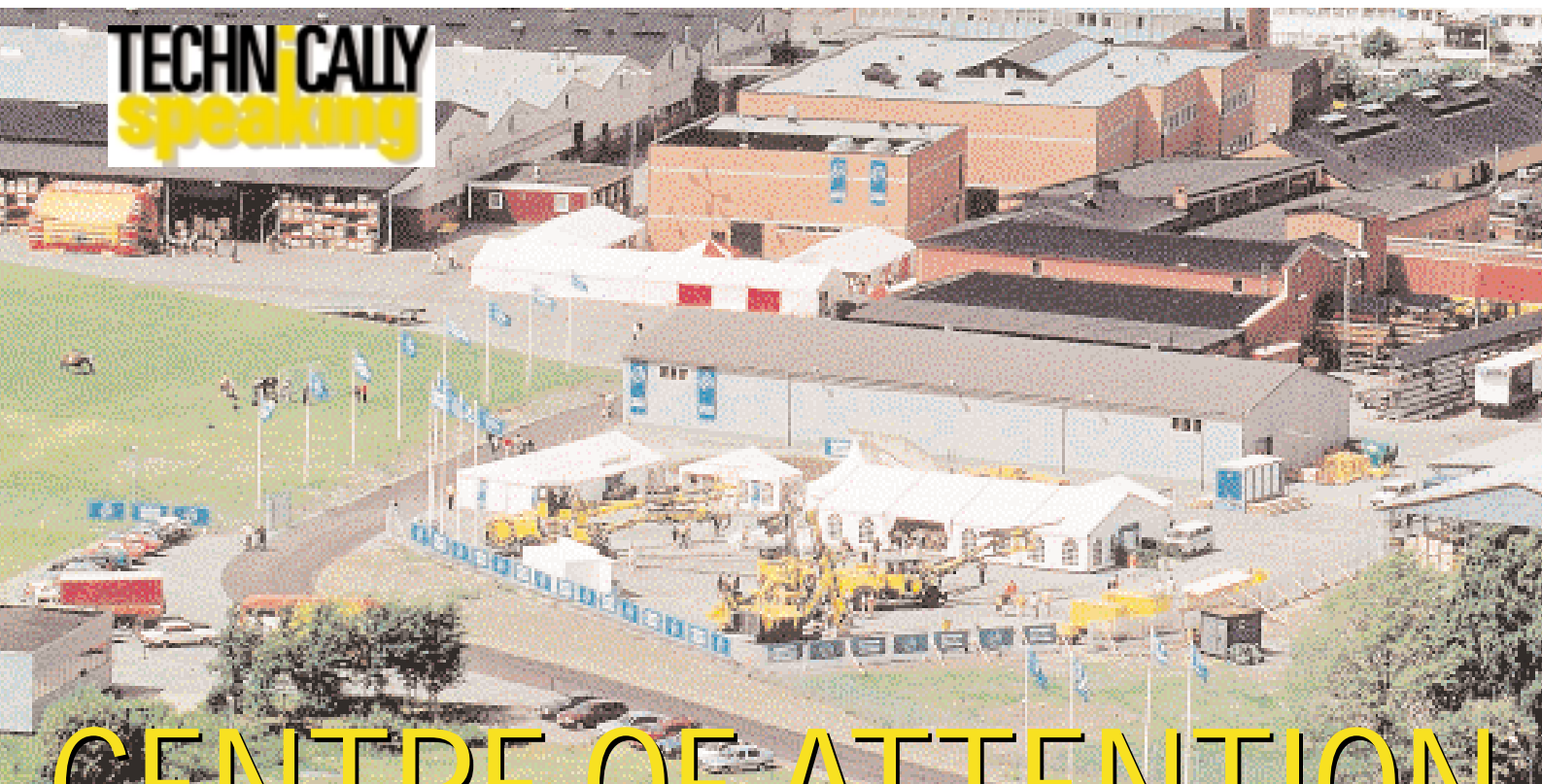


TECHNICALLY
speaking



CENTRE OF ATTENTION

The town of Örebro in central Sweden is not internationally known but it is rapidly being recognized around the globe as a world centre for research and development in rock excavation technology. Here's why:



By Sverker Hartwig
Vice President, Research &
Development, Atlas Copco
Rock Drills.

It has been an exciting and eventful six years since we first began to concentrate our production, design, marketing, and research and development activities for Atlas Copco Rock Drilling Equipment to Örebro. It was a bold move based on an even bolder vision – to bring all our expertise under one roof and then exploit this combined know-how for the benefit of our customers.

Judging by the result, there is no doubt that this strategy was absolutely spot-on! Since 1998, our Rock Excavation Technology Center has been the catalyst for all of the research and development, marketing and assembly of drill rigs, for both surface and underground applications, taking drilling technology to unprecedented heights.

Thanks to this collective “brainpower” the new generation rigs have enjoyed full-scale improvements, involving numerous innovative developments that have enabled these machines to become industry leaders and our customers to reap the benefits of higher productivity and greater efficiency in drilling operations than was ever thought possible.

And that’s not all. As we now plan to relocate our LHD production facilities from Wagner in the United States to Örebro as well, our control of the three key functions – drilling, rock reinforcement and hauling – will be complete and

strengthen our position even further as the technology leader.

So let’s take a look at how this competence centre came about.

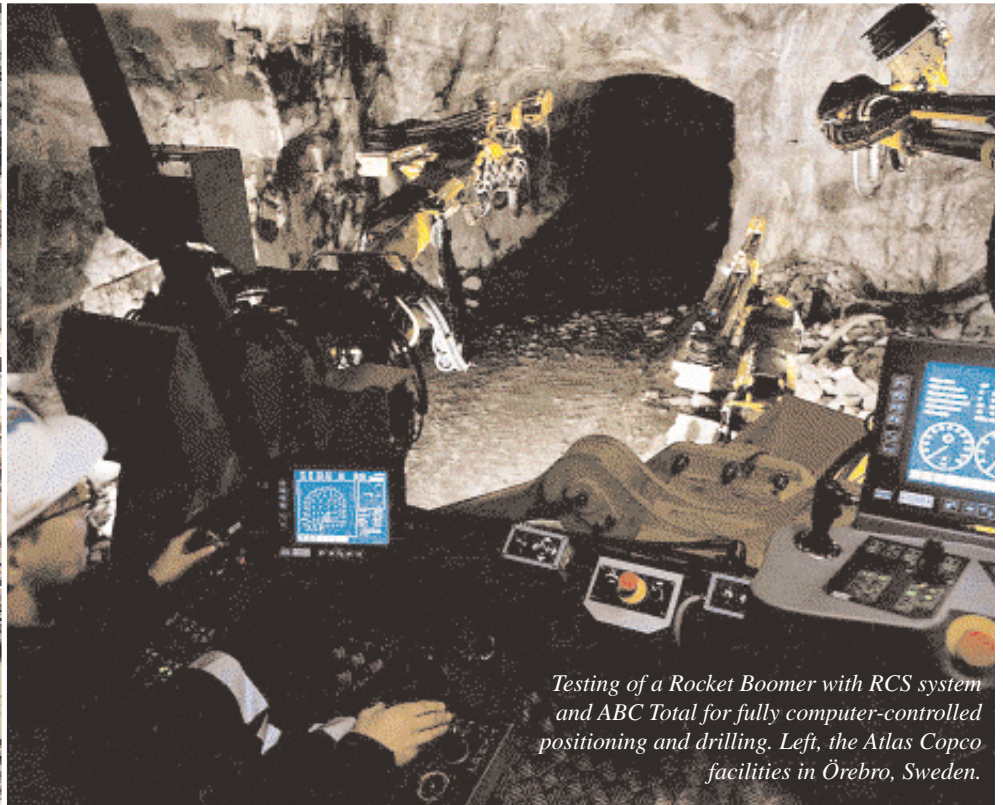
Foresighted approach

With the production of underground rigs already in place, we took the decision in 1995 to move the production of all surface drilling rigs to Örebro as well. This gave us the opportunity to form a collective knowledge base, drawing on the strengths of both areas, and placing them side by side under the same roof.

The list of products now under development in Örebro caters to almost every drilling application within tunnelling, mining, bolting and raiseboring, and since 1996 nearly 30 different types of new drill rigs have come off the assembly lines.

In this way, you could say that we have really lived up to our three key principles – interaction, commitment and innovation – in the best interests of our customers. But more importantly, our total costs for product development have decreased significantly during the same period, despite the higher output, which, in turn, has enabled us to invest even more in the search for new ideas and cost-effective solutions.

Several factors have driven these successful developments, not least that we created an R&D organization that for the



Testing of a Rocket Boomer with RCS system and ABC Total for fully computer-controlled positioning and drilling. Left, the Atlas Copco facilities in Örebro, Sweden.

first time could function as one entity across national borders, ensuring the development of the best products possible.

Enter the computer!

In 1996 we also launched the ROC F7, which was a clear step forward for surface crawlers in its day. And the development continued right up to 2002 with the introduction of the ROC D7 C, the first fully-computerized surface drill rig. Interestingly, both of these rigs were launched at the prestigious Con-Agg exhibition in the U.S.

Two years later, in 1998, at Atlas Copco's 125th jubilee, the next generation Rocket Boomer rigs was introduced with a great fanfare as the first fully-

computerized underground rig series. In addition to the computerized advantages, the new series also came equipped with a newly-designed ergonomic operator's cab.

By using CAN-bus technology as the basic platform, we developed the Rig Control System (RCS) with Advanced Boom Control (ABC) for all of our modern drill rigs and also provided numerous add-on software tools such as Tunnel Manager, Measure While Drilling (MWD) and the Drill Plan Generator system.

As many M&C readers know, the ABC system is available in three levels: Basic, Regular and Total. Basic has instrumentation for angle measurement of the boom

positions. Regular includes a PC guidance display for positioning the booms to a pre-selected drilling pattern, with completed holes marked on the display and individual logging of each round on a PC card.

Once this initial platform was developed, it enabled us to apply the same system to all of our rigs. Initially built for the Rocket Boomer rig, RCS was later applied to the Simba, Boltec, ROC D7 C and Diamec U 6 rigs and this year to the Robbins 97 RL C raiseboring rig.

Since these ground-breaking introductions, several other milestones have also been reached. In 2001, significant developments and improvements have been made with the Simba and Boltec rigs where Atlas Copco has cooperated

Major product launches since 1996

Surface Drilling

ROC F7
ROC F7 CR
ROC F6
ROC D7
ROC D5
ROC F9
ROC F9 CR
ROC L7
ROC L7 CR
ROC L8
ROC L6
ROC D7 C

Underground Drilling

Rocket Boomer L2 C
Rocket Boomer M2 C

Rocket Boomer M2 D
Rocket Boomer L3 C
Rocket Boomer XL3 C
Rocket Boomer WL3 C
Rocket Boomer L1 C
Rocket Boomer L1 C/DH
Rocket Boomer L3 C-2B
Rocket Boomer S1 L

Simba M2 C
Simba M3 C
Simba M4 C
Simba M6 C
Simba M7 C
Simba L6 C
Boltec MC
Boltec MD

Boltec LC
Boltec LD
Boltec SL

Rock Drills

COP 2550
COP 1838HF
COP 1532

Raisedrills

Robbins 34RH Boxhole
Robbins 53RH High Power
Robbins 73 RM VF-drive
Robbins 97 RL C

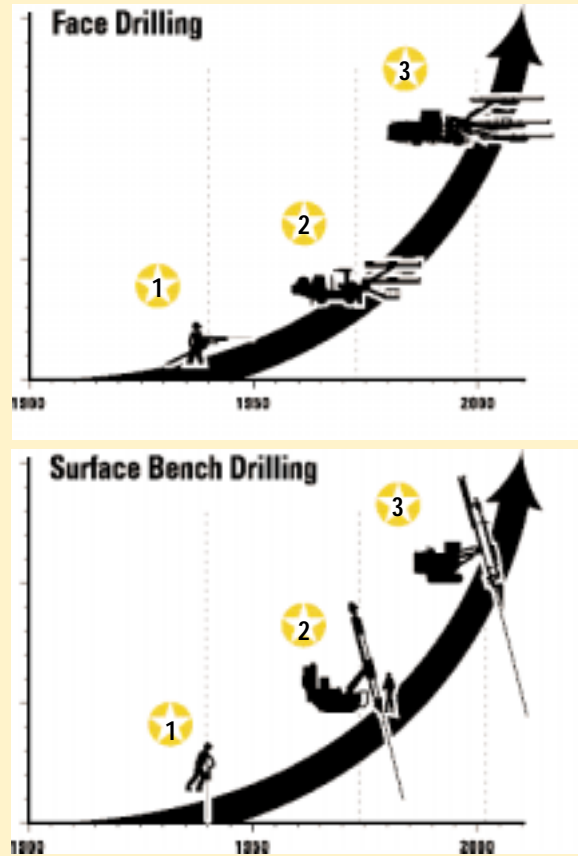
Control Systems

RCS, ABC, MWD, Drill Plan Generator, Tunnel Manager
Rock Manager, Ore Manager

CR= Coprod, C=Computerized Rig Control System, D=Direct Hydraulic Control System



Milestones in drilling technology



FACE DRILLING

1. 1940s
Swedish Method
Pusher leg drilling
Approx. capacity 10 m/hr
2. 1973
Hydraulic rock drilling
First generation
2 boom rig, COP 1038
Hole diameter 51 mm
Approx. capacity 125 m/hr
3. 2000
Rocket Boomer L3 C, ABC Total
3 boom rig, COP 1838 HF
Hole diameter 51 mm
Approx. capacity 275 m/hr

SURFACE BENCH DRILLING

1. 1940s
Handheld drilling
Approx. capacity 5 m/hr
2. 1974
Hydraulic crawler rig
First generation
1 boom, COP 1038 HB
Hole diameter 76 mm
Approx. capacity 30 m/hr
3. 2002
Computerized ROC D7 C
1 boom, COP 1838 ME/HE
Hole diameter 76 mm
Approx. capacity 60 m/hr

▶ extensively with the Zinkgruvan mine, in Sweden, just 50 km from the Technol-ogy Center.

Modular design

Another key contributor to progress has been the actual design of the products. For example, there are about 17,700 pieces involved in the assembly of our latest Rocket Boomer L3 rig. And because of this, we have invested countless hours in finding the most efficient, cost-effective method of streamlining the manufacturing and assembly process.

As result, we now have a modular-design concept for all of our products which means that whenever we upgrade – a cab for one of the rigs, for example – we are, in essence, upgrading the cabs for all of the rigs at the same time. Furthermore, the modular system makes it much easier to modify the rigs to meet customer specifications.

I maintain that to create a very technically advanced and complex product is a rather simple task. What we are trying to do is create products that are easier to use and contain fewer components.

Customer gains

Combining all our knowledge and resources under one roof gives us the opportunity to pass on these benefits directly to our customers in a more effective manner than ever before.

The standard computer interface on our rigs allows us to easily update software and provides increased savings and flexi-

bility for our customers. And with shorter operator training periods, users who can operate one type of rig can quickly and easily learn to operate another.

As we all know, time is money, and by relying on computerized systems our customers are able to produce more during the available work time. The support systems we provide make it easier to ensure that the operator is doing the job correctly and data collection is the perfect guide that leads to better results.

Along with this comes increased precision as accurately placed holes means less overbreak, which, in turn, reduces the cost of rock reinforcement, loading and hauling. In tunnelling, the cost of an additional concrete lining, due to the differences in overbreak, is of the same magnitude as the cost of drilling and blasting.

As our rigs are designed in a parallel manner, there is greater availability of common components. This means faster repairs, better service and maintenance and also allows customers to

keep their stocks of parts on site to a minimum.

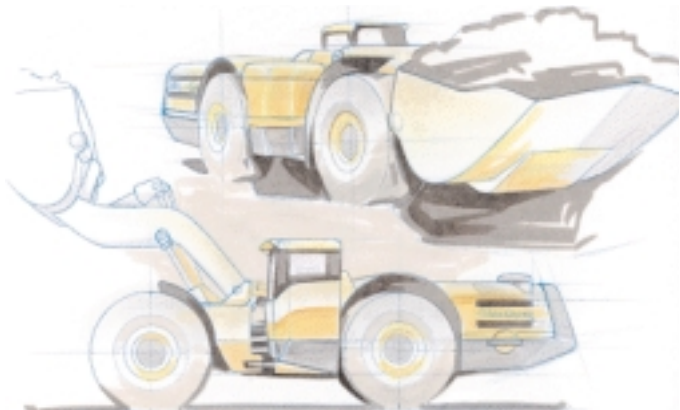
Passing the test

In 1997, we began an intensive redesign of the entire production facility at Örebro. A new, 3,200 m² central lab was built for the testing of new ideas and concepts. The lab houses the latest equipment for running the rigs through rigorous testing at every stage of their development. Whether it be computerized boom positioning or dropping huge boulders on the roofs of the cabs, the tests are performed over and over to make sure that each component of every rig meets the same high standards.

When the drill rig prototypes have been built, they are then put to the test in drilling applications. Surface rigs are put through their paces at the outdoor test site located right next to the Örebro plant while underground rigs are taken to our own test mine in Nacka, near Stockholm, where they can be tested in “real life” mining and tunnelling situations.

People make the difference

As only a few of our highly skilled personnel in Stockholm could make the move



to Örebro, we were forced to hire new people. These young, well-educated people were supported by the older, more experienced employees and this transfer of experience and know-how has continued.

New horizons

Now we have entered a new era in the way we design and develop products, from the creation of new ideas, all the way to the final testing phase. And I am convinced that by combining all of our resources into one location, Atlas Copco has the cutting edge in product development.

The addition of the Wagner product line will provide us with another great challenge, giving us the opportunity to apply all the experience and know-how that has benefitted our drill rigs and other products in the past few years. We have also made sure that the Wagner know-how will follow the transfer to Sweden and with this as a base and all the synergies that exist here in Örebro I am convinced that our Wagner products will come to dominate the world market.

In spite of it all, the real test of our products takes place after they have left our hands and go to work for our customers – low height solutions for the platinum miners of South Africa, drill plan generation for Garpenberg mine in Sweden, precision drilling with the ROC L8 for the Chuquicamata Mine in Chile ... the list of where Atlas Copco know-how is really making a difference is extensive.

We have come so far in the past six years that it has become difficult to predict where we will be in another six. At Atlas Copco, innovation, interaction and commitment are our guiding stars as we constantly strive to satisfy our customers. And in spite of all the products that we have successfully introduced in recent years, I can assure you that there is much more in the pipeline. Or to quote Winston Churchill: this is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning.