

CAT MAGAZINE

CATERPILLAR INDUSTRIAL DESIGN:

FROM EVOLUTION TO REVOLUTION

HJERKINN, NORWAY:

HARD AT WORK WITH EMPTY CABS

MAKKAH TO MADINAH, SAUDI ARABIA:

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SMOOTHING THE WAY BETWEEN MADINAH AND MAKKAH

How effective service speeds railway
construction in Saudi Arabia



Dear Reader,

I'm sure you'll agree with me that advances in technology are only justified by the genuine improvements they deliver in terms of performance, savings and safety.



That's why, in this issue, I want to share some of the ways in which we and our dealers are partnering with you to achieve this. In the following pages you'll read about how joint development of a remote control system in Norway is ensuring operator safety in a dangerous environment. Also, for the first time we reveal some revolutionary new Cat machine concepts designed to meet your earthmoving needs two decades ahead. In addition, we explain how collaboration in on-site service management ensures minimum downtime during construction of the Middle East's first high speed railway.

To me, these and other stories are vivid illustrations of how Caterpillar's unique working relationship with you, our customers, is always the best way to get the job done. Individually we are strong, but together we are unbeatable!

Paolo Fellin,
Vice president Caterpillar

SHAPING THE FUTURE BY REMOTE CONTROL

Working with empty cabs for safety's sake in Norway



FROM EVOLUTION TO REVOLUTION

Caterpillar industrial design reveals
the future of earthmoving



YOUR OPINION!

Thank you all for your responses to our Reader Survey. We are busy analysing the results and plan to share them with you in the next issue.

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Above is just a taste of what's in this issue – you'll find plenty more news and views inside. If you have an idea for a story for a future issue, contact our publishers on CatMagazine@cat.com

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SHAPING THE FUTURE

BY REMOTE CONTROL





Across an empty sub-arctic landscape in central Norway a Cat 730 articulated truck inches towards a distant earth embankment, where another Cat machine – a 324D excavator – stands ready to load it. The 730 manoeuvres into position alongside the excavator and the loading of earth ripped from the embankment begins. A normal enough jobsite scene at first sight. But move closer, look into the machines' cabs and you'll see – no-one at all. The operators are in fact controlling the Cat machines from a control room in a modified steel container sited on high ground more than three kilometres away.

So why this unique way of working? It's a story whose history goes back 87 years, and one that looks set to change the way machine operators will work in hazardous environments in years to come.

[More](#) ▶

AT WORK WITH EMPTY CABS



BACK TO NATURE

Dovre National Park covers an area of 289km² and is visited by thousands of people every year. But one part of it is strictly out of bounds to visitors – the Hjerkins firing range.

Covering 165km², the range was established in 1923 as an artillery firing zone and was in use until the end of 2008. Its closure left the problem of how to remove more than 50,000 rounds of unexploded ordnance still littering the site and restore it to its natural state.

Meeting the challenge is Norwegian contractor Brødrene Gjermundshaug Anlegg AS. Founded in 1949, the company has earned a reputation for tackling out-of-the-ordinary assignments. Current owner and general manager Jan Inge Gjermundshaug says: "We thrive on new challenges and always have, ever since my father started the business. As a result, for a number of years we have done work for – among other customers – the Norwegian armed forces, and this latest project continues that tradition."

The first phase of the restoration, scheduled for completion in 2011, involves removing 80,000m³ of earth in two long embankments sited behind targets in the artillery ranges. These may contain significant amounts of undetonated explosives. Subsequent phases will involve the reclamation of a former bombing range and the removal of some 90km of roads.

Four Cat machines are working on the project. A 324D excavator lifts material from the embankments. It is then transported five kilometres by two Cat 730 articulated trucks to a former gravel pit, where a 312D excavator disposes of it. Any explosives found during the

operation are dealt with by Norwegian Army explosives experts who are always on call close to the site.

"Because of the danger," says Jan Inge, "we knew it wouldn't be possible to operate the machines in the normal way. So we set about developing a remote control system for them."

CLOSE COLLABORATION

The remote control system had to be operational by the project start date of 10th August last year, and involved collaboration between Brødrene Gjermundshaug, Norwegian Cat dealer PON Equipment, electronics specialists Cavotec and Data Equipment, and video technology specialists Spectro Remote.

PON Equipment's Kai Ronny Løvtjernet takes up the story: "Our relationship with Brødrene Gjermundshaug goes back a long way. The company bought its first Cat machine in the mid-1950s and currently has over 20 machines. The trucks and excavators for this project had to be able to be operated normally as well as by remote control, so they were supplied as standard 2009 models. Modifications to the hydraulic systems for remote operation were carried out by Gjermundshaug's own mechanics."

"We have a good, close relationship with PON Equipment, to keep our equipment up and running," confirms workshop manager Håvard Tronsmoen. "And the decision to choose Cat equipment is always an easy one. When you have Cat machines you can sleep easily. We keep our machines for between three and five years and spend a lot of time keeping them in shape. But we know we'll get a good resale price when we sell them, and you can't say that about every make of machine."



Dovre National Park, established in 2003, covers an area of 289km² at altitudes between 1,000 and 1,700 metres, and is home to wild reindeer and Europe's only herd of the rare musk oxen.



"In this instance," he adds, "the Cat machines' hydraulics systems were not so difficult to adapt to remote control, although the electrical and electronic linkages took more time than we had expected."

GOING THE DISTANCE

There are four main elements to the remote control system. The machine-mounted controls comprise a mixture of electronics – known by operators as the 'Black Cat Box' – and hydraulic valve assemblies. The four operator control units in the steel container, complete with joysticks, control panels and pedals, mimic the machines' own controls. A high capacity signal transmission system links the operators with the machines, for accurate control of all functions at distances as great as six kilometres. And finally, a high definition video system gives operators the guidance they need for accurate, safe operation.

Development posed fewer problems than expected. Data Equipment's Tore Andreassen says: "The data transmission

Interference from military signals traffic also had to be dealt with by Data Equipment. A nearby military communications post was found to generate electronic noise, so aerials were equipped with shields to diminish the interference.

More ▶



JAN INGE GJERMUNDSHAUG, owner and general manager, Brødrene Gjermundshaug Anlegg AS: "We thrive on new challenges and always have."

"It was a learning process for everyone – new equipment, new ways of working."

Jan Inge Gjermundshaug

and reception technology is well understood, even though we had to 'stretch' it a little to cope with the distances involved. The truck mounted aerials presented a challenge, because their distance from the static control room aerials, and their tilt relative to them, vary as the machines move. We've found the solution though – gyroscopes mounted on the trucks' and excavators' aerials maintain an optimal angle to the static aerial."

Operators at work controlling their distant machines, with communication and control provided via machine mounted antennas and video cameras.



For Specto Remote the major challenge was the data transmission rate needed. It had to be high enough to eliminate any delay in the transmission of the high definition pictures from the eight cameras on each Cat machine. In practice there were no problems coping with these critical needs, but for the future the plan is to adopt 3D video to make the system even more operator friendly.

The final judgment, however, must rest with the operators. Håvard Thoresen, one of four working in the control room, has over 16 years' operating experience and still claims that he has one of the world's best jobs. "It has been an unusual experience," he says, "learning to do what I do while sitting in a steel box kilometres away from where I'm actually working. It took about two weeks to become confident with this new way of working. At first we had a few difficulties keeping everything under control, but now there are no problems."

AN INVESTMENT IN TOMORROW

Does Jan Inge Gjermundshaug see a future beyond this project for Cat machines fitted with remote control? His answer is emphatic: "Of course. Think of the number of environments where working conditions can be hazardous. The oil and gas industries, for example, or a recent power station project where machines had to work in a tunnel. The roof collapsed, killing one person. With remote control that wouldn't have happened. Certainly we have spent a lot of time and money developing this remote control system, but I am convinced that over the coming years we shall reap the reward for our efforts many times over." ■

MAINTENANCE TIPS

TO MAXIMISE MACHINE LIFE AND PRODUCTIVITY



HYDRAULIC EXCAVATOR

Regular inspection and maintenance in accordance with your hydraulic excavator's Operation and Maintenance Manual minimises downtime. It locates and remedies potential and overlooked problems, and helps reduce owning and operating costs. In this article we offer some essential tips to ensure that maintenance is carried out safely and effectively.

INSPECTION PREPARATION

1: PLAY IT COOL

For safety's sake, when it comes to checking engine coolant levels and topping up when necessary, remember never to remove the radiator cap unless the engine is cold.

2: KEEP A SURE GRIP



When parking in the standard service position, remember to maintain three points of contact with the machine when climbing on and off.

3: THE KEY TO SAFETY

Always attach a "Do Not Operate" tag to the machine's start switch and make sure it remains there throughout the maintenance process.

LOWER-LEVEL INSPECTIONS

4: KEEP IT CLEAN

Before removing a dipstick, filler cap or plug when checking and adjusting the oil level in the final drives, make sure you wipe round the area to ensure that no dirt or contaminant enters the oil system.

MIDDLE-LEVEL INSPECTIONS

5: ADVICE WHERE IT'S NEEDED

While inspecting the cab interior, always remember to make sure that there is an Operation and Maintenance Manual present in the cab.

UPPER-LEVEL INSPECTIONS

6: ACCURACY COUNTS

When checking the air cleaner during inspection of the turbocharger, be sure to check the accuracy of the air filter service indicator. Refer to the Operation Maintenance Manual to see how to do this.



7: REPLACE ALL V BELTS

If, when inspecting belts and pulleys, you find a V belt that needs replacement, then you should replace all the other V belts that transfer motion to the same pulley as well, rather than just that one.

8: RELEASE THE PRESSURE

When inspecting the main hydraulic control valve, first release any pressure still present in the hydraulic system by turning the engine start key to the 'on' position (without starting the engine) and moving the joystick through the full range of travel. Then return the key to the "off" position and turn the battery disconnect switch to the 'off' position.



See the manual here
www.uk.cat.com/maintenance

THE DRIVING FORCE FOR HIGHER PRODUCTIVITY

HOW CAT TECHNOLOGY OFFERS BENEFITS BEYOND SIMPLY MEETING NEW TIER 4 EMISSION REGULATIONS

Tana Utleby is a woman on the go. As Caterpillar's chief technology officer and vice president of the Product Development Center of Excellence in Peoria, Illinois, she drives the development of all new Cat machines. And with new, tighter Tier 4 emissions legislation due in Europe and the USA in 2011 and 2014, she is faced with introducing over 350 new Cat products in just four years. So what drives her, and how will the development process she controls result in more productive Cat machines?

FOCUS ON STRATEGY

Cat yellow blood flows in Tana's veins. When she was small her father took an engineering job with the company, and she followed him in 1986. "I never intended to be an engineer," she says. "I was going to major in music, but changed my mind. I wanted variety, along with an interesting career, and decided that engineering could give me both."

Over the years the nature of the problems facing her has changed. As an engineer she worked on individual products. She now has a more strategic focus; devising technology that will provide the greatest benefit to Caterpillar customers. And the forthcoming Tier 4 regulations, demanding reductions of up to 87 percent in NOX emissions and up to 95 percent reductions in particulate matter from off-road diesel engines, present one of her greatest challenges to date.

DEVELOPMENT FOR PRODUCTIVITY

"Our customers," says Tana, "want to move earth, not worry about Tier 4. So we focus our development on providing clear benefits for them. Therefore our Tier 4 compliant machines must also provide improved productivity."

"Some of the technology is new, but the primary focus has been on melding a range of technologies developed over the past 20 years. It's a process of fine-tuning

"Concentrated 24-hour testing of complete machines, dramatically improves development efficiency."

combustion, air and injection systems, and electronics. We're looking at greater systems integration to use power in the most effective way."

"The most noticeable development," she adds, "is probably the new Cat Clean Emissions Modules. It's a family of around two dozen after treatment systems to fit every Cat off-road machine, replacing over 200 separate mufflers."

PROVING THE POINT

Innovative evaluation technology plays a significant role. Computer simulating techniques, for instance, are benefiting from more powerful computers, allowing engineers to discover potential problems in the computer rather than later, on prototype machines.

"We made a big investment in component validation too," states Tana. "An engine facility doing prototype calibrations now works 24/7. And we have a "shake table" that recreates the worst vibrations components will be subject to in the real world. It simulates 10,000 hours of operation in just 500 hours.

"Then there's the Peoria Development Center in the USA, a facility now equipped with an indoor arena covering several acres where everything can be controlled, including even soil moisture. It's dramatically improving our development efficiency."

PARTNERING WITH THE BEST

Tana is also tasked to look further ahead. "We have a number of people working on future technologies, and we maximise resource use by partnering with the world's best in various fields. So we have worked with NASA and are collaborating with Carnegie Mellon University in Pittsburgh on machine autonomy. With Parma University in Italy we're developing a vision system for future remotely controlled machines. And we're working with many other academics in other countries."

"But whatever we do and whoever we partner with," she adds, "it's always with one clearly focused aim – to develop new Cat machines that will work ever more effectively and cost efficiently for our customers worldwide." ■



REACHING OUT FOR THE MOON

As part of a recent project aiming to allow men to return to the moon and establish a permanent base there, NASA scientists worked in partnership with Cat engineers to develop technology for a multi-use lunar vehicle. Initial work, focused on a Cat 287C multi terrain loader platform, concentrated on the provision of automated machine functions and their integration with existing technology like 3D animation into a remote control package.

Cat automation control manager on the project, Eric Reiners, says: "We were working on a system in which data, transmitted wirelessly, provides a distant operator with a 3D animation of the machine and its movements. The aim is to provide remotely controlled mobility on the moon, plus the ability to accomplish infrastructure tasks. These could include building a launch pad, burying cables, and earthmoving for buried living accommodation, all of which are necessary for a permanent base."

WHEEL LOADER 966H





ECO-DRIVE TRAINING

THE FAST TRACK TO LOWER FUEL COSTS

Today's construction equipment is more fuel efficient and less polluting than ever, but even the most frugal piece of machinery needs to burn some diesel in order to do its job. This is where the machine operator can make a contribution – and a far greater contribution than many might suppose.

DRIVING DOWN COSTS

Research has shown that simple techniques, such as reduced engine speeds and correct machine positioning, can cut fuel consumption by up to 15 percent. And with fuel accounting for about one third of a machine's running costs, it clearly pays to invest in some operator training.

Caterpillar has taken the initiative by developing its Eco-Operator Training scheme, a one-day course explaining how the operator can improve fuel efficiency, maximise productivity and reduce carbon emissions.

DEMONSTRATING THE GAINS

In May 2009, UK Cat dealer Finning launched its own version of the course, called Eco-Drive, which is designed to inform and educate maintenance staff and fleet managers as well as the operator. "Anybody who is involved with the machine – the operator, fitter, plant manager and so on – needs to know about Eco-Drive" says Steve Platt, National CAM development manager with Finning.

At a recent Eco-Drive course held at CAT's Desford facility near Leicester, delegates spent the morning learning the theory before stepping outside to see trained operators give demonstrations of both good and bad practice. Sensors fixed to the machine (in this case, a CAT 950H wheel loader) sent data via wireless link to a laptop displaying fuel consumption and RPM in real time. The theory is simple: Choose the correct machine settings, operate the machine smoothly, don't over-rev the engine, avoid unnecessary manoeuvres and work using correct operator technique. And yet, as Steve Platt observed, "people underestimate the impact

ROB POWELL, STRATEGIC ACCOUNT MANAGER, FINNING

"Some of the big aggregates companies spend £10 - 20 million a year on fuel alone."

"If you can reduce that by 10 - 15 percent, you're looking at a major saving. And you're cutting your carbon emissions at the same time."

of operator inefficiencies. They assume that hard work requires high fuel consumption". This is simply untrue.

LOWER EFFORT, HIGHER PRODUCTIVITY

Research shows that lowering the engine speed by 20 percent when tipping a load on a dump truck can achieve a 45 percent reduction in fuel consumption. Similarly, the higher you lift a load, the more fuel you burn. So in a wheel loader, setting the tipping-height and kick-out to suit the hopper or truck body will improve economy and productivity.

The same goes for loading: wheel slip means wasted effort, so achieving the right bucket angle and deploying Aggregate Auto-Dig (if available) will cut fuel consumption and enhance productivity.

Operator technique has a big impact on maintenance costs as well as fuel consumption. On tracked machines, running the tracks backward accelerates wear; on wheeled machines, careless driving causes tyre damage. Only 7 percent of tyres ever wear out; around 80 percent are destroyed prematurely by cuts or impact damage. Working with worn or damaged ground-engaging tools (GET) is also wasteful, explained Adam Lyon, service training advisor with Finning. "Penetration takes more effort and you're less likely to fill the bucket properly with worn GET" he said. "You should try to match the GET to site conditions so as to achieve the optimum balance between strength and wear".

SIGNIFICANT SAVINGS

During the afternoon's practical demonstration the extent of the savings achievable became clear. Undertaking load-and-carry operations, the CAT 950H achieved a cycle time of 3 mins 16 sec when operated poorly (corner-loading the bucket, failing to engage the bucket at the correct angle, lifting the bucket too high and operating at high revs). Fuel consumption during the test cycle was calculated at 1.34 litres.

Simply by making some adjustments to the machine settings and rectifying these bad habits, the same operator achieved a faster cycle time (2 mins 38 sec) and cut fuel consumption to 0.89 litres. At current fuel prices, this equates to a saving of €3420 over a 48-week year.

Similarly, when loading the articulated dump truck using a 345B excavator, it took 1.74 minutes to fill the truck – which seems quite respectable, until by simply positioning the articulated dump truck closer to the wheel loader the same operators achieved a cycle time of just 1.01 minutes. Combined with better operating techniques, this increased hourly productivity from an estimated 661 tonnes/hour to nearly 1,140 tonnes/hour.

REAPING THE BENEFIT

Leading aggregates producer Cemex is an enthusiastic advocate of Finning's Eco-Drive training. Cemex trialled Finning's Eco-Drive scheme in April 2009 with a series of one-to-one sessions involving six hand-picked operators. "We have a Specific Energy Consumption [SEC] target for every single one of our sites and reducing diesel consumption is a priority," says Craig Hooper, the company's national operations manager: "That's why we send our operators for Eco-Drive training. We can measure our performance but we can't provide the training required to improve it. The results were amazing we saw up to 11 percent reduction in fuel burn and between 20-25 percent increase in productivity". Since this pilot study, some 330 Cemex employees have undergone Eco-Drive training with another 110 due to complete the training this year.

LESSONS LEARNED

The world's mine and quarry operators are among Caterpillar's biggest customers. They spend huge amounts on purchasing, running and maintaining their equipment fleet, and can easily spend up to €20 million a year on fuel alone.

Simply by deploying Eco-Operator techniques, that fuel bill can be cut by 10-15 percent, a major cost saving. At the same time the operator reduces carbon emissions, minimises wear and tear on the machine, boosts productivity and lowers his own physical and mental fatigue.

Not a bad result for one day's training! ■



VIRTUAL TRAINING WITH A REAL WORLD PAYBACK

Learn more
www.cat.com/simulators



WHAT USERS SAY

PIETRO BUONO, TRAINING COORDINATOR, AREVA NC / IMOURAREN SA, NIGERIA*

"The different modules enable us to assess future drivers' capabilities in the mine. Usually they go through 12 hours of training, which saves us time and, more importantly, allows us to train them safely."

ANGEL LUIS GONZALEZ, SKILLS DEVELOPMENT CONSULTANT, THE MALAGA DEMONSTRATION AND LEARNING CENTER, SPAIN:

"It's an inexpensive way of training new operators. For instance, a 627G scraper burns around 60 litres of fuel per hour, so training an operator for 10 hours instead of using the actual machine, saves the cost of 600 litres of fuel!"

To get the highest performance out of your machines, it's essential for them to be handled by properly trained operators. But on-machine training diverts machines from revenue-earning tasks and can put inexperienced operators and machines at risk. So how can operators be trained to work efficiently without risking mishaps, and without a cost penalty? Turn to the Cat Virtual Training System and the problem's solved.

Cat simulator training familiarises your operators with machine controls and teaches proper handling before they begin to train on actual machines. A variety of exercises develops each of the component skills associated with operating actual machines in different work environments. By uniting simulated worksite applications and conditions with realistic controls, the simulators provide hands-on learning without the risks and costs of traditional training. And of course the system is also ideal for experienced operators looking to extend and refine their skills.

Trainees progress from entry-level control orientation through to complex operator exercises, with difficulty increasing as successive modules build on the skills acquired in the previous ones. At every stage the training offers instant feedback to help measure improvement.

SAFETY FIRST

By pre-training your operators on a Cat simulator, you'll more effectively ensure the safety of your inexperienced operators because they'll be able to:

- practice difficult manoeuvres until they have fully mastered them
- acquire skills in a controlled, safe environment

- learn safe operating procedures and – for experienced operators – break any bad habits
- train at any time
- address any fatigue issues without risk.

THE PAYBACK: LOWER COSTS, HIGHER PRODUCTIVITY

Because your machines keep you earning revenue rather than being diverted for training, you'll benefit from:

- optimum productivity due to added machine availability and more effective training
- reduced maintenance
- longer engine life
- lower fuel costs
- the ability to train multiple operators on multiple machines without tying down machines.

Your Cat dealer will be happy to let you know what Cat simulators are available to meet your particular training needs. ■

KNOW MORE SO YOU CAN DO MORE



What is the real cost of moving each tonne of material on your jobsite? Are your machines and operators working at optimum efficiency, or could changes to work patterns boost your productivity? Call in the Cat Production Analysis Truck and you'll get the answers to these and other production-related questions, giving you the opportunity to cut costs and maximise production.

Since 2008 the Cat Production Analysis Truck has been hard at work as an integral part of an overall production analysis service, unique to Caterpillar, which can be called on to look at every aspect of on-site operations.

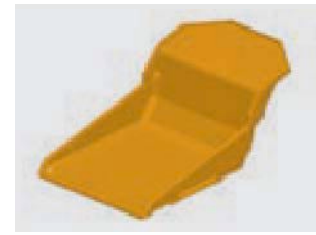
Caterpillar quarry division applications specialist Claude Binchet has been undertaking production analysis for customers for over a year, accompanying the truck on visits to quarry sites. "In a quarry," he says, "the total service can include analysis of the efficiency of haul roads and loading area operations, as well as the performance of all machines on site. We look at the entire operation, everything concerned with extraction, hauling and support equipment. But however comprehensive and complex the overall analysis, the aim is simple – to provide our customers with accurate, real world data about their operating efficiency on site that will help them improve productivity, minimise downtime and save money."

The Production Analysis Truck, claims Claude, performs a vital role, thanks to its ability to assess production differences between machines, provide payload verifications and comparisons, and validate machine performance. "It's a fast worker too," he says. "In one two-month period in 2009, it was in action on behalf of no fewer than 13 customers at sites in France and Germany. During that time it carried out performance analyses on a total of 26 off-highway trucks – Cat trucks and others. In total, some 700 payloads were analysed."

Beyond truck performance assessment, the production analysis truck can also help analyse on-site operator performance, providing information that can be used to adapt operating procedures and patterns for greater efficiency, and as the basis for future operator training. In order to provide comparative data for this kind of assessment, a skilled operator from either the local Cat dealer or the Caterpillar Malaga Demonstration and Learning Center will sometimes be present.

"The truck also brings another, less obvious benefit to customers," adds Claude. "It provides Caterpillar development engineers with greater understanding of how Cat machines are actually used and can be used. That's feedback that helps improve the breed in future. One recent result, for example, is the new quarry body for our 770 and 775 trucks (as featured here in the right-hand column), introduced at this year's Bauma trade show in Germany."

To find out how the production analysis truck can help improve efficiency and cut costs on your job site, contact your local Cat dealer. ■

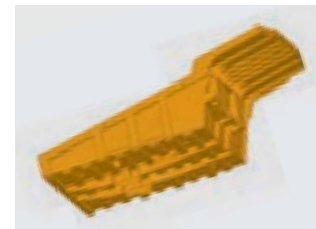


NEW QUARRY BODY

770F AND 772F

Floor: 25mm
Frontwall: 16mm
Sidewall: 14mm

All base plates 400HBN Steel
Floor ribs tie directly into sidewall ribs



775F

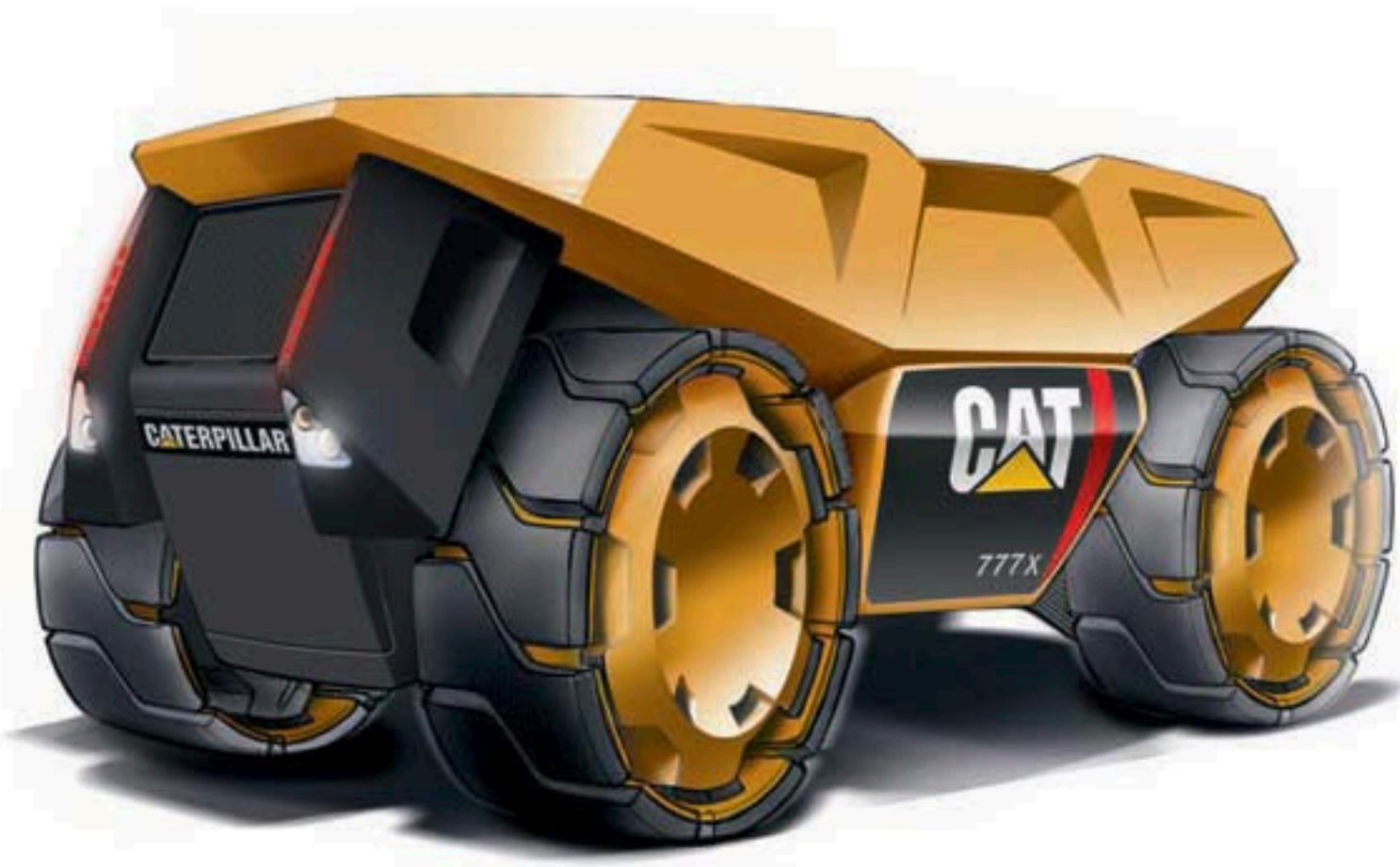
Floor: 25mm
Frontwall: 16mm
Sidewall: 14mm

All base plates 400HBN Steel
Floor ribs tie directly into sidewall ribs



See more
www.mycattv.com/PAT

FROM EVOLUTION TO REVOLUTION



GARY BRYANT,
Caterpillar industrial design
group manager.

In the first of three articles showcasing the work of the Caterpillar industrial design group, we take a look at their mission, what motivates them, and how they work to meet the earthmoving challenges and needs you face.

FINDING NEW WAYS OF MOVING EARTH

In 2004 Gary Bryant, manager of Caterpillar's industrial design team, was tasked with presenting to the company's Global Brand Identity Council his unit's latest project. Called 'Breaking New Ground', it was a glimpse into what Cat machines could look like in 2014 and 2020. When he had finished there was a moment's awed silence. Then Stu Levenick, Caterpillar group president and chairman of the Global Brand

Identity Council, spoke: "Gary," he said, "we don't want to wait that long, we need to pull these designs forward." This is the team's major focus.

Based in Peoria, Illinois, the group has existed for over 50 years and consists of a team of highly qualified, experienced designers. They provide a comprehensive range of industrial design services, from ongoing evolution of current product lines to 'blue skies' thinking and concept development. The group's expertise combines the technical aspects of design and machine appearance, with the emphasis now rapidly shifting from work on single machines to the creation of machine 'families' with a common, distinctive Caterpillar identity.

Gary says, "We deal with everything from designing a new switch to the creation of a total machine exterior. People tend to think of us as stylists, but in reality what we do is a blend of art and engineering. And we never turn to external design consultancies, so everything we do springs from and reflects the Caterpillar culture and community."

He also emphasizes the single-minded focus of all their work: "Whether we're working on current products or looking into the future, our goal is simple – to produce more productive, cost-effective machines. If our customers like our styling too, that's great, but it's not our primary interest – or, usually, theirs either."

A TOTAL OWNERSHIP EXPERIENCE

Work on current products occupies around 85 percent of the group's time, with 15 percent devoted to longer term thinking. Naturally it's the 15 percent that commands immediate attention, thanks to the startlingly futuristic look of some of the resulting design studies. But the group's principles and guidelines don't change when they're producing concepts such as the off-highway truck pictured here.

"Safety, quality and productivity still rule," says Gary. "That's why our 777X, quality concept combines a huge load capacity with oversize wheels for stability at high speeds on rough terrain. And

simultaneously. Control information may be transferred by satellite, so we'll be able to operate machines at or beyond the limits of human vision.

"And we're not just talking about machines; we're talking about a total ownership experience. A Cat machine will have to be one in which tomorrow's operators will actively want to spend eight to ten hours a day. It must be an experience they enjoy.

"And in order to achieve that, who knows? Maybe we'll be moving earth by means other than a mechanical bucket. By sound waves perhaps. Is that feasible? Not right now, of course, but paradigms will change. And it will be the Caterpillar industrial design group who help show the way forward."

In the next issue of Cat Magazine we will highlight some more of the design concepts recently developed by the Caterpillar industrial design group. ■



it's why there's no cab. After all, nothing delivers greater operator safety than remote operation."

Gary also points out that most of its technology is available today. "It's fundamental that we create concepts that we know can be produced," he says. "We look at the second generation forward from today's machine. That's only around 18 years ahead, so to make sure that what we produce will actually function is essential."

"We regard the Cat machine as an extension of the human hand."

The group's brief, however, extends beyond simply creating concepts for 'new versions of current machines.' Devising and assessing entirely new ways to manage the whole earthmoving process are central to their mission.

"As we go forward," says Gary, "the human/machine interface will change. Remote operation may allow us to operate more than one machine

This D8X track type tractor concept features fully integrated track, and the option of either remote control or a movable cab for optimum safety and visibility (see above).

SMOOTHING THE WAY

BETWEEN MADINAH AND MAKKAH

In 632 AD Prophet Muhammad (Peace be upon Him) led his followers from Madinah in a pilgrimage to Makkah. Following his example, that same journey is now undertaken by over three million devout Muslims from all over the world taking the trip to Makkah every year. In order to promote their safety and comfort on the Hajj, the Government of the Kingdom of Saudi Arabia recently took the decision to build a 444km high-speed railway line linking these two holy cities via the Red Sea port of Jeddah. Scheduled for completion in just three years, the first phase of the Haramain High Speed Rail Project requires over 120 million m³ of earthworks – a task requiring over 180 Cat machines to work flat out in difficult terrain, high temperatures and dusty conditions. So what does the project involve and how are the Cat machines kept operating at peak efficiency in such a demanding environment?



"200,000m³ of concrete, 2 million m³ of aggregate, 500,000m³ of asphalt – all the figures connected with this project are impressive," says Mohamed Shouman, project director of Riyadh-based contractor MASCO. "And time is limited. We started work in April 2009 and the first test train is scheduled to run on the track in 2012, so delays are not acceptable. That's why we chose Cat machines for the project. We know we can rely on them to perform, and we know that the service we receive from our local Cat dealer Zahid Tractor will ensure that they will stay up and running however difficult the conditions are."

More ▶



DUSTY WORK IN A TOUGH ENVIRONMENT

In some areas, in addition to high ambient temperatures, Cat machines are faced with an abrasive mixture of fine sand and hard volcanic rock.

80 CAT 14M MOTOR GRADERS

are employed, creating a smooth surface with maximum 4 percent gradient which will allow trains to travel at up to 360km/h.



RAPID MAINTENANCE AND REPAIR FACILITIES

provided by Caterpillar dealer Zahid Tractor at six bases along the route ensure minimum downtime and maximum productivity.



Machines ordered for the project include 40 D9R track type-tractors, 80 14M motor graders and 60 966H wheel loaders.

On parts of the route the conditions are as tough as they come. Although over 80 percent of it follows fairly level ground that is not unduly difficult to work, the northern section, south of Madinah, crosses remote, hilly terrain that consists of a mix of fine sand, boulders and hard volcanic rock masses – a challenging proposition for earthmoving equipment, particularly when high temperatures make difficult operations even more demanding. A close working partnership between MASCO and Zahid Tractor has been the key to keeping everything moving on schedule.

PARTNERSHIP FOR EFFECTIVE SERVICE

It's a relationship that began even before the contract was awarded. Zahid Tractor representatives accompanied MASCO on their visits to the Saudi Railway Organisation to ascertain machine requirements for optimum productivity. Then, with the contract won, Zahid Tractor not only supplied the Cat machines for phase one of the project, but also set up comprehensive on- and off-site service resources.

"The aim," states Ishtiaq Malik, Zahid Tractor's on-site service supervisor, "was to complement MASCO's own maintenance facilities, and the work of their mobile crews providing routine maintenance directly at the jobsites. We needed to make certain we achieve maximum machine availability and productivity for MASCO. To do that, we made arrangements to ensure correct machine usage, correct preventive maintenance, and the correct handling of oils and fuel. The availability

of parts along with Zahid and Caterpillar service personnel to fix any problems that might occur were also essential. All this was in place by the time work began.

"In addition, because the working conditions can be tough, we've put in place a regular oil sampling programme, carried out by Zahid Tractor's own Scheduled Oil Sampling (S.O.Ssm) laboratory in Jeddah. So if contamination is found, then the oil can be changed before there's any major damage. It's all part of the drive to maximise machine up-time and productivity on the project."

Operator training is also provided by Zahid Tractor. Mansour Sallam AL-Absi, MASCO sector manager on one of the most demanding parts of the project, says: "There's a shortage of operators here in Saudi Arabia, so some are inexperienced when we recruit them. Others have had experience with Caterpillar machines, but not on the latest machines that we're using here. So, experienced or not, they all need training. And of course good training makes a significant difference when you're dealing with difficult ground. If operators don't really know what they're doing, machine breakage is inevitable. Rather than break and fix, it's faster and cheaper for us to make sure they're properly trained before they start work."

It's a policy that's evidently paid off, as Cat 14M motor grader operator Iftikhar Wahab confirms. Experienced on older Caterpillar models, he is enthusiastic about working with the 14M. "It works much faster than other machines," he says, "and by comparison with them it's very easy and comfortable to operate. On this job I am covering a greater area in the same time and can work for a long time before getting tired." ■

HEAVY GOING

One of the 40 D9R track-type tractors in the MASCO fleet hard at work shifting material in difficult terrain.



ISHTIAQ MALIK

Cat dealer Zahid Tractor's service supervisor, on site throughout the project.



MANSOUR SALLAM AL-ABISI

MASCO sector manager: "Good training makes a significant difference when you're dealing with difficult ground."



FOR A CAT D7F IN TUNISIA

LIFE BEGINS AT 30+

Even for the most durable of machines, a life working in the extreme conditions of the Sahara desert is bound to take its toll. So it was no surprise when a Cat D7F track-type tractor, bought in the early 1970s and with over 40,000 operating hours on the clock, was finally written off. But that wasn't the end of the story.

BOUCHAMAOU INDUSTRIE

has been in existence for over 100 years. Since 1900, three generations of the Bouchamaoui family have led the company through more than 1,000 projects in Tunisia and neighbouring countries. The company currently handles business in the areas of steel construction, welding and long distance pipe installation.

Bouchamaoui Industrie is one of the longest established oil and gas contractors in Tunisia. In today's difficult economic climate, one way for the company to stay competitive is to keep their equipment fleet – mostly Caterpillar machines including hydraulic excavators, track-type tractors, pipelayers, wheel loaders and motor graders – up to date. In order to pursue this aim, the company recently took a decision to progressively renew their fleet, which was aging and in danger of becoming unproductive.

"Because replacing a fleet rapidly requires a big financial outlay, instead of buying new equipment we proposed rebuilding their current machines instead," Anouar Ben Ammar, executive manager of local Caterpillar dealer Parenin SA explains: "We have now finished

changed the hoses, redid the electrical installation and replaced the old engine with a new one. We also sandblasted and repainted the structure," says Anouar.

The rebuild was completed in just two months, with a team of four experienced technicians working eight hours a day to meet the deadline.

The D7F has now returned to work as a pipelayer, digging trenches, and undertaking road construction. It is the same job, in the Sahara desert, in which it had already clocked up more than 40,000 hours since the early '70s.

Who says you only live once? ■

"The rebuild was a great choice – not only economically but also ecologically."

rebuilding the first machine, a D7F track-type tractor, for a price that's only 40 percent of the price of a new machine. This also includes a one-year warranty period. Given that the D7F was no longer in use but had been dumped as scrap, the rebuild was a great choice – not only economically but also ecologically."

The D7F is now as close to a new machine as a used piece of equipment can be. "We rebuilt the transmission and undercarriage, straightened the blade and ripper,

ON THE ROAD TO SUCCESS

WITH THE CAT RM500

When most of your roads are unpaved, but it's vital to find a cost effective way keep transport moving, what do you do? In Cameroon and on the Spanish island of Fuerteventura, the answer was clear-cut. Bring in the Cat RM500 rotary mixer.

CAMEROON – A COUNTRY ON THE MOVE

Cameroon in West Africa is located between Nigeria and Equatorial Guinea, and sits on the eastern part of the Gulf of Guinea. Of the country's estimated 50,000km of roadways, only a small percentage is paved, so maintaining dirt roadways is vital to allow commerce to move efficiently from one region to the next. To meet changing and demanding conditions in an important road stabilisation project in N'Dokoti, near the port of Douala, contractor Sogea Satom chose a Cat RM500 rotary mixer supplied by local Cat dealer Tractafric.

Crews from Sogea Satom first compacted the road's existing surface using a Cat PS300 pneumatic roller, then spread a cement mixture on top. The RM500 took one pass over the surface, reclaiming to a depth of 20cm, while at the same time mixing the materials to the contractor's exact size and uniformity requirements.

Thanks to the RM500's enhanced features, including a unique mixing chamber, precise depth control, mid-machine rotor and three rotor speeds, unsurpassed

"The RM500 means roadways can be maintained more economically."

blending of the materials was achieved. A water spray and final round of compaction completed the project, and produced the durable surface that's now helping keep Cameroon's road transport up to speed.



FUERTEVENTURA – BENEFITING THE BIOSPHERE

Also working to maintain its developing transportation infrastructure is the Spanish island of Fuerteventura. The island is a coveted tourist destination, but summer temperature extremes and blinding sandstorms mean maintaining its 500km of roads, most of them unpaved, can be challenging.

Fuerteventura's government works with municipalities to ensure roads remain accessible and provides the heavy machinery required.

Recently they took delivery of a new Cat RM500 Rotary Mixer to help renovate roads throughout the island. Previously roads were maintained by shipping and trucking in material, which was spread, graded, wetted down and compacted. This required transporting a whole

fleet of machines and their operators. Today, the RM500 means Fuerteventura's roadways can be maintained more economically, with fewer shipped-in materials creating far less environmental impact – important since the island is considered a protected biosphere reserve.

Rosa Vera and Beatriz Suarez of Fuerteventura's Works and Machinery Department note that local Cat dealer Barloworld Finanzauto's support has given them the confidence to turn to Caterpillar time after time. For them, a critical factor is: "what one gets after the sale – that the mechanic will be on hand when needed, that spare parts are here, and that we can get them quickly." As a result, the island's road construction and maintenance fleet includes numerous Cat machines ...and now the new Cat RM500 rotary mixer. ■



The Cat RM500 at work in Fuerteventura (main picture), and near Douala in Cameroon (above).

CAT RM500 ROTARY MIXER:

Cat C15 Engine with ACERT™ Technology
Gross power (SAE J1995) at 2000 rpm:
403kW
Net power (ISO 9249) at 2000 rpm:
403kW
Rotor width:
2438mm
Rotor depth (maximum):
508mm
Operating weight:
with universal rotor 28,410kg with combination rotor 27,150kg



Learn more
www.mycattv.com/RM500



Watch our wheel loaders in action
www.mycattv.com/MWL

1959 CAT FLASHBACK



The 944 wheel traxcavator, Caterpillar's first wheel loader.

Introduced 50 years ago, with a 1.5m³ bucket and either a 78kW petrol or diesel engine, it was the culmination of seven years of development – and the beginning of Caterpillar's leadership in the worldwide market for mid-size wheel loaders.



Originally bought by the Norwegian Army, this 922B wheel loader is now owned by the Norwegian Railway Club, and is still in regular use for loading track ballast, moving equipment and clearing snow.



Greek builder Nikos Kotelides owns this 1960 944A. Previously owned by his uncle for about 24 years, it is still fully operational and is now used for small landscaping projects.



This 1960 922A is the property of Swiss farmer Waldy Beney, who uses it for around 150 hours a year for snow removal, distributing food to his animals, and general load carrying.

E-SERIES BACKHOE LOADERS



Let's talk

E, BUT NOT AS YOU KNOW IT

Looks can be deceiving. Next time you see a Caterpillar E-series Backhoe Loader, you might have to look again. It's still the E: a versatile machine with a low cost of ownership, but not as you knew it. Though the changes may not be obvious at first glance, Caterpillar has implemented numerous customer-driven improvements. They make the new E-series even more productive, more durable, more comfortable and easier to service.

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When your business is the **EARTH**,
it makes sense to take care of **BUSINESS**.



INTRODUCING THE NEW CAT® D7E WITH ELECTRIC DRIVE.

Redesigned from the ground up, the D7E helps conserve the world's natural resources by consuming less over its long working life. By using fewer fluids, filters, service items and replacement parts, it costs less to own and operate than any other track-type tractor in its class.

The D7E also uses 10 percent to 30 percent less fuel per hour, while moving up to 25 percent more material per liter. That reduces total greenhouse gas emissions as it helps you save money and get more done.

The D7E helps you move the earth more efficiently and effectively, while helping to take care of our planet's increasingly valuable resources. That's good for your business and good for the earth.

Contact your Cat Dealer to find out more about the Cat D7E, or visit: www.cat.com/D7E.

**As measured in material moved per unit of fuel. All percentage figures are as compared with the D7R Series 2.*

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