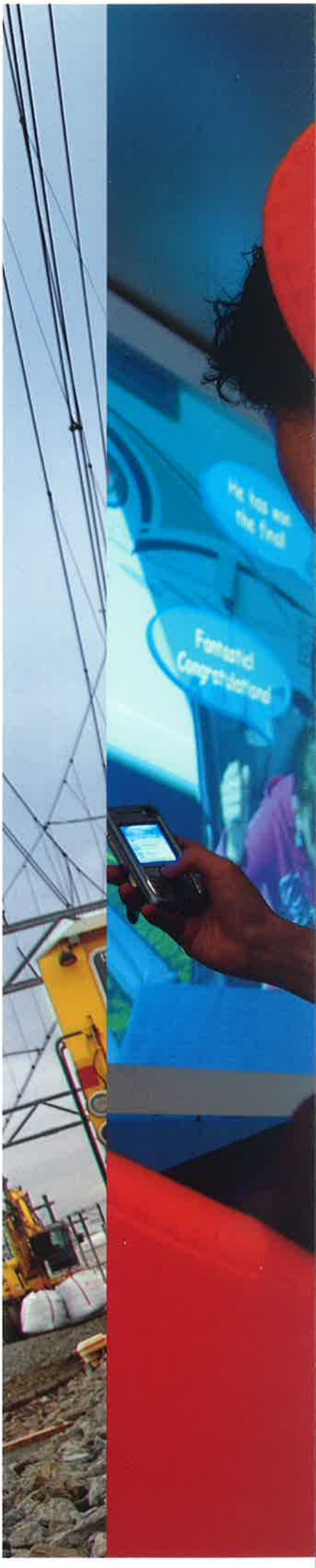
TNO Annual Review 2005



Characterisation for 2005:

An effective and efficient TNO

Ambition for 2006:

A relevant and a distinctive role for TNO

TNO in 2005

Content

In matters of interpretation the more extensive Dutch version of the Annual Review will prevail.

Key figures

(in EUR x million)

	2005	2004	2003
TNO: (TNO Organisation including group companies)			
Government funding turnover	195.8	194.5	188.6
Market turnover	366.1	361.3	364.4
Turnover	561.9	555.8	553.0
Net turnover [1]	495.3	491.0	487.8
Added value [2]	398.8	393.8	399.4
Operating result before impairment of (in)tangible fixed assets	10.0	3.8	-47.6
Impairment of intangible fixed assets	-	-	-1.6
Impairment of tangible fixed assets	-2.6	-	-5.6
Operating result	7.4	3.8	-54.8
Result	7.9	4.7	-52.2
Result as % of the market turnover	2.2%	1.3%	-14.3%
Number of employees (effective average)	4,746	4,979	5,123
Number of employees (effective average at the end of the year)	4,648	4,900	5,052
Net turnover per employee (effective average) in thousands of euros	104.4	98.6	95.2
Added value per employee (effective average) in thousands of euros	84.0	79.1	78.0
Personnel costs per employee (effective average) in thousands of euros	75.4	72.4	70.1
Personnel expenses excluding additional pension payments	357.7	360.6	359.1
Additional pension payments	-	-	56.8
Operating capital	38.0	31.1	37.3
Equity	181.3	173.4	168.8
Cash flow	42.9	36.8	-9.0
Investments TNO Organisation	27.3	29.8	27.1
Investments group companies	6.6	20.8	10.4
Current ratio	1.27	1.23	1.28
Solvency	0.47	0.45	0.46

[1] Net turnover = turnover - direct project costs

[2] Added value = net turnover + other operating income - other operating costs

	2005	2004	2003
TNO Organisation			
Government funding turnover	195.8	194.5	188.6
Market turnover	305.1	299.4	307.4
Turnover	500.9	493.9	496.0
Operating result before impairment of (in)tangible fixed assets	6.8	0.9	-51.5
Impairment of intangible fixed assets	-	-	-1.6
Impairment of tangible fixed assets	-2.6	-	-5.6
Operating result	4.2	0.9	-58.7
Result (excluding result for group companies)	5.6	2.4	-57.2
Operating result TNO Core areas	8.7	5.7	-52.4
Result TNO Core areas	9.6	7.1	-50.8
Number of employees (effective average)	4,216	4,473	4,598
Number of employees (effective average at the end of the year)	4,108	4,389	4,569
Average term of work in progress and debtors in months (TNO Core areas)	2.8	2.7	3.2
Solvency	0.50	0.50	0.49
Group companies			
Turnover	65.2	64.7	60.5
Operating result	3.2	2.9	3.9
Result	2.3	2.3	5.0
Number of employees (effective average)	530	506	525
Number of employees (effective average at the end of the year)	540	511	483

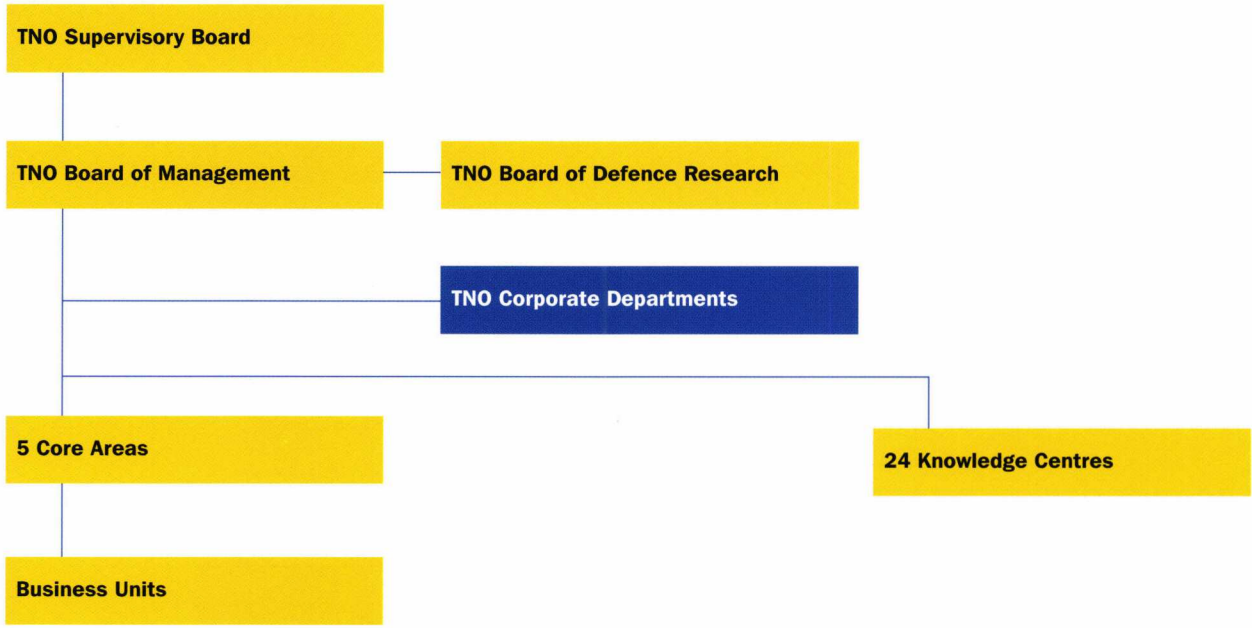
Composition of the Boards

Supervisory Board As of 1 april 2006		
J.M. Leemhuis-Stout, M.Sc., *chairman*	Since 01-03-2001	Chairman of the Dutch Hospitals Association (NVZ)
Prof. Dr. M.C.E. van Dam-Mieras	Since 01-05-2000	Professor of Sciences, in particular biochemistry and biotechnology at the Dutch Open University
Prof. Dr. L. Koopmans	Since 01-02-1999	Professor at the University of Groningen and non-executive director of companies, chairman of the board of directors at Rabobank Nederland
G-J. Kramer, M.Sc.	Since 01-09-2003	Former Chairman of Fugro, various company board positions and commissionerships
A.H.J. Risseeuw, M.Sc.	Since 01-07-1996	Former Chairman of Getronics, various company board positions and non-executive directorships
J.G.F. Veldhuis, M.Sc.	Since 01-09-2003	Former Chairman of the Board of Governors of Utrecht University (1986-Nov.2003); various chairmanships and memberships of supervisory boards, executive boards and advisory committees
Dr. E. Veltkamp	Since 01-05-2003	Former Senior Vice President Research and Development at Unilever N.V.
Drs. H.P. Drop, M.Sc.		Secretary

TNO Board of Management As of 1 April 2006		
J.C. Huis in 't Veld, M.Sc., *chairman*	Since 01-11-2003	Member of the Advisory Boards at Rabobank Nederland, at Allseas B.V., at the Public-Private Partnership Knowledge Centre (Min. of Finance), Member of Advisory Council 'Kennis en Innovatie' (Min. of Transport, Public Works and Water Management), Member of the Steering Council 'Regieraad Bouw' (Min. of Economic Affairs), Member of the Boards of EUROTECH, EARTO and the Technical Sciences Board of the Royal Netherlands Academy of Arts and Sciences
Dr. C.M. Colijn-Hooymans	Since 01-10-2002	Member of the Boards of CimmyT (Mexico), of the Foundation Catholic University Nijmegen, of the King Willem I Foundation and of Wageningen Centre for Food Sciences, Supervisory Director of the Laboratory for Crop and Soil Analysis, Member of the Supervisory Board of Van Eeghen International B.V.
C. van Duyvendijk	Since 01-07-2003	Member of the Boards of the National Aerospace Laboratory, the Netherlands Defence Manufacturers Association, the Royal Netherlands Sea Rescue Institution and the Dutch Maritime Network. Member Advisory Board of the Netherlands Agency for Aerospace Programmes, Member of the Supervisory Board Willemsoord B.V.

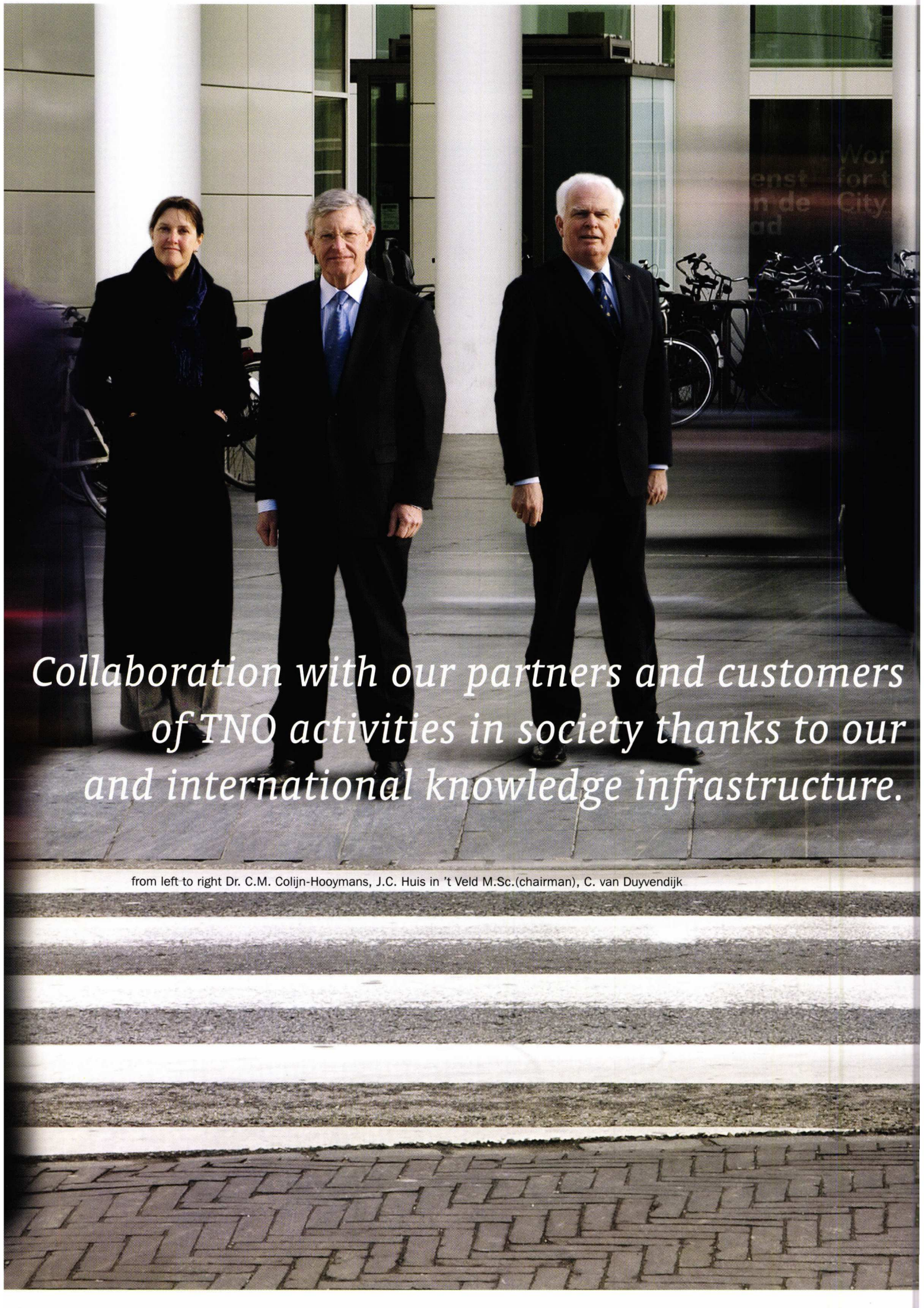
Defence Research Council As of 1 April 2006		
C. van Duyvendijk, *chairman*	Since 01-07-2003	TNO, Member of the TNO Management Board with Defence portfolio responsibility
RAdm D. van Dord, M.Sc., *Deputy chairman*	Since 01-01-2003	Ministry of Defence, Chief Director of Materials
L. le Duc, M.Sc.	Since 01-08-2004	Head of the Department of Scientific Areas, Research and Science Policy Board, Ministry of Education, Culture and Science
RAdm P. Bedet	Since 26-05-2004	Ministry of Defence, DMO, D-DMKM
M.G. A.C.J.Besselink, M.Sc.	Since 01-04-2005	Ministry of Defence, DMO, C-Matlogco
M.G. E.H. Evers	Since 01-12-2004	Ministry of Defence, DMO, D-DMKlu
Brig. J.P. Spijk, LLM	Since 01-10-2004	Ministry of Defence, Policy Staff, HDP, D-DPB
Col. M.J.H. van Uhm	Since 01-01-2005	Ministry of Defence, Policy Staff, DS, DOBBP, OB, Head of the Future Concepts Branche
Prof. Dr. E. Backer, M.Sc.	Since 01-10-2000	Professor of Information and Communication Theory, TU Delft, Expertise Development Manager, Telematica Institute
Prof. Dr. U.A.Th. Brinkman	Since 01-09-2004	Professor, Faculty of Science University of Amsterdam
Drs. P.D. van der Koogh, M.Sc.	Since 01-05-2004	
Prof. Dr. R. de Wijk, *special member*	Since 01-06-1992	Professor, Leiden University, Senior Researcher at Clingendael
E.F.W. Bleeker	Since 01-10-2004	secretary

Organisation Structure



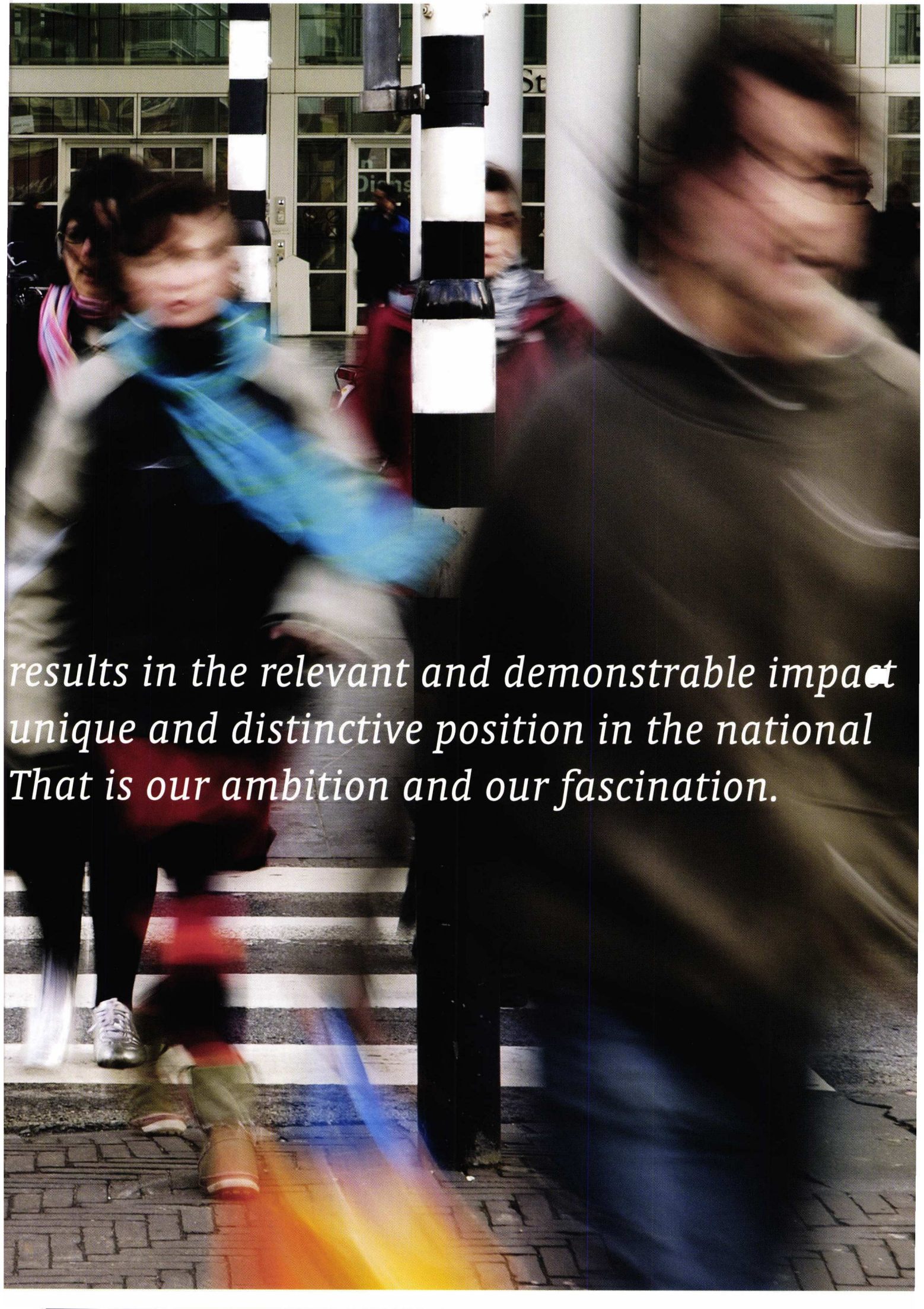
TNO was established by law in 1932 in order to support companies and government that did not have their own R&D capacity. TNO is an organisation that is able to give an objective scientific assessment, independent of private or public interests.

In most cases TNO's customers exercise the option to exploit themselves the knowledge developed by TNO. But TNO also is commercially active with the knowledge it develops, putting this knowledge directly into the marketplace. This commercialisation is in the hands of TNO Companies BV, an entity separate from the public TNO organisation. Shareholdership by the public TNO organisation enables knowledge to be channelled to the private domain. This public-private organisational structure of TNO is also a response to the very latest market and government insight.



Collaboration with our partners and customers of TNO activities in society thanks to our and international knowledge infrastructure.

from left to right Dr. C.M. Colijn-Hooymans, J.C. Huis in 't Veld M.Sc.(chairman), C. van Duyvendijk


results in the relevant and demonstrable impact
unique and distinctive position in the national
That is our ambition and our fascination.

An effective and efficient TNO: that was our ambition for 2005, and in many areas we have achieved it. A large part of the improvement plan that we drew up in 2004 with this in mind was implemented in 2005. TNO's new organisation, which consists of five related core areas, has now been in operation for a full 12 months. Even closer cooperation has been developed with trade and industry, knowledge organisations and government bodies. These changes have enabled TNO to realise a primary objective of the reorganisation process that began in 2004 – to increasingly offer our customers integrated solutions – and the progress made in the ongoing improvement in the cooperation between the various disciplines within TNO has been really noteworthy.

We're constantly improving our ability to offer our customers comprehensive solutions.

The increased efficiency and effectiveness have had tangible results: with an average of 252 fewer employees than in 2004 we have been able to raise our market turnover to EUR 366 million.

Organisational developments

The plan to work in core areas was first proposed in the Strategic Plan 2003-2006. At this stage, the core areas were described as broad thematic research areas. Only in 2005 did the core areas also become organisational units. This development was motivated by changes in the national and international innovation climate that compelled us to work more effectively and with greater efficiency. The reorganisation plans anticipated the recommendations of the Wijffels Commission in May 2004. The next step in TNO's development is described in the Strategic Plan 2007-2010.

Strategy 2007-2010

In 2005 a start was made on our Strategic Plan for the period 2007-2010. In accordance with the TNO Act, TNO draws up a strategic plan every four years. The plan was presented to the Minister of Education, Culture and Science at the end of the first quarter of 2006. The Cabinet will evaluate this plan and look at the consistency between the TNO organisation's priorities and major societal and economic themes. Using the interdepartmental meeting as the forum, the draft strategic plan has been discussed with the government on a couple of occasions. These discussions have tended to focus on the demand-led themes and programmes and the basis they provide for the government's new form of knowledge-development funding.

In developing the new Strategic Plan, entitled United through Innovation we have benefited greatly from the three round-table meetings that we held with a number of our major business relations, a group that includes leading players in Dutch trade and industry, the knowledge world and the relevant ministries departments. These meetings allowed for a frank and honest exchange about TNO's position and ambition, and the role that our organisation must fulfil for society.

TNO's primary ambitions, as stated in the strategy, may be summarised as follows:

- To collaborate with companies, government bodies and knowledge institutions
- To undertake activities of relevance that have a demonstrable impact on society
- To occupy a unique and distinctive position in both the national and international knowledge infrastructures.

Our ambition implies that we extend our collaboration with other knowledge institutes and companies, frequently into strategic partnerships.

Collaboration in the knowledge infrastructure

TNO is part of both the national and international knowledge infrastructures. In pursuit of our ambition we must extend our cooperation with other knowledge institutions and trade and industry ever further, often through strategic partnerships. This is happening, for example, in the 24 knowledge centres with universities and companies and through close cooperation with organisations like the Netherlands Association of Universities of Applied Sciences (HBO-Raad), the Dutch Association of SMEs and the Confederation of Netherlands Industry and Employers (VNO-NCW). Internationally, too, TNO stepped up its cooperation in 2005, for example with the Russian Academy for Sciences.

The importance and influence of the European Union are increasing, in part through legislation and regulations and in part through the effects of the common market and the emergence of a European knowledge infrastructure. Together with the universities, the research and technology organisations (RTOs) involving more than 100,000 researchers form the backbone of the European Research Area. There are some 800 RTOs and all are engaged in applied research. The top three RTOs in Europe are Fraunhofer Gesellschaft in Germany, TNO and VTT in Finland.

In the reporting year, we undertook a number of other important initiatives and forms of cooperation.

In 2005 steps were made to form the Delta Institute, in which the Dutch State and the non-profit organisations WL/Delft Hydraulics and GeoDelft will be participating alongside TNO. On 24 February 2006 the Cabinet adopted the proposals made by the steering committee. The way is clear for the Delta Institute to come into being in 2007. TNO is working hard to foster close cooperation between this new institute and TNO Built Environment and Geosciences; working as knowledge centres, both entities are applying their complementary skills to tackle the problems of densely populated delta areas, the Netherlands in particular.

In September 2005 the Cabinet decided to make FES (Fund for Economic Structure Improvement) monies available for innovation programmes intended to improve strengthen the Dutch knowledge infrastructure. The initiatives undertaken by TNO pertaining to the Holst Centre for micro-electronics and the Automotive Knowledge Centre in Eindhoven were positively received. The Holst Centre was formed in cooperation with Belgium's Interuniversity MicroElectronics Center (IMEC), Philips and other companies. The founding of the Automotive Knowledge Centre in cooperation with the Eindhoven University of Technology (TU/e) has prompted the move by TNO to concentrate all its automotive activities in the Eindhoven region in the coming years. A FES contribution was also allocated to the new nano-facility in Delft, a joint initiative with the Delft University of Technology (TU Delft).

In the course of 2005 the National Innovation Platform advised that, with a view to stimulating Dutch innovative power, a number of key areas should be defined in which the Netherlands wishes to achieve international prominence. The Minister of Economic Affairs has adopted the recommendation and chosen the key areas. TNO is co-initiator of a number of the submitted select areas, namely 'High-tech Systems & Materials', 'Flowers & Food', 'Water' and 'Creative Industries'.

In its role as knowledge intermediary, TNO organised the second Sport and Technology Conference, at which companies, knowledge institutions and sports organisations were brought together.

At the Innovation Event run by the Ministry of Transport, Public Works and Water Management, TNO was co-signatory to various innovation agreements: for water, aviation and construction. TNO also played an active role at the National Innovation Event on 7 December hosted by the National Innovation Platform.

Market

The starting point for any successful strategic cooperation is a thorough knowledge of our customers and their markets. In 2005 greater professionalism was brought to our relationships with major customers. An account manager was appointed for each of our large and strategic customers. For these customers, this means one contact point and faster, easier access to TNO.

The organisation's IP position is a useful indicator of the extent of our knowledge transfer and is essential if the TNO companies are to accumulate value over time.

Our account managers offer customers a single point of contact within and thus faster and easier access to TNO.

Total turnover, TNO 2005 (EUR 562 million)

Market turnover, TNO Organisation (EUR 562 million)

TNO's aim is steady growth year on year in the number of inventions protected by patent. In 2005 the number of first applications rose by four to 90. TNO's ambition is to get this figure up to 100 in 2006.

Success at home has enabled TNO to build a strong position and a solid base from which to expand internationally. We have a presence in both Europe and North America as well as in developing markets such as Russia and East Asia. TNO is convinced of the need to operate internationally if it is to be able to offer Dutch trade and industry and the Dutch government knowledge of international excellence and to remain an attractive employer to top researchers.

The SME sector

Cooperation with SMEs is and will remain important for TNO. More than half our turnover from Dutch trade and industry is earned in the SME sector. In 2004 an SME plan was drawn up and this is being used to give small and medium-sized enterprises with the drive to innovate or apply technology easier access to TNO. This plan took effect in 2005. Our ultimate aim is to offer the SME sector the TNO products and services it needs. Specific sector account managers for SMEs have been appointed to implement the plan.

The SME knowledge vouchers, an initiative of the National Innovation Platform, have proved a great success. The vouchers are intended to afford SMEs easier access to knowledge institutions. A quarter of all vouchers issued in the first round were 'spent' on TNO knowledge. Another way to facilitate the knowledge-building relationship with TNO is the TNO Challenge, also set up in 2005. This is a unique and free instrument that TNO is offering SMEs: a team of experts to solve a problem at an SME company within one week.

TNO and the STW Technology Foundation have launched a Small Business Innovation Programme (SBIR). The aim is to improve and accelerate the market launch of knowledge developed in public research institutions and to actively involve start-ups and small businesses in this process. This is the first programme of its type in the Netherlands and it will strengthen the country's innovative power. In this respect, it is consistent with not only TNO's mission but also the mission of the National Innovation Platform.

TNO has also started auctioning its unique inventions and findings. This was first done during the Innovation Event hosted by the National Innovation Platform. In the coming years, more auctions of this type will be organised.
In 2005, 11 businesses were acquired or set up; two

More than half of our Dutch business turnover comes from the SME sector.

TNO and STW have initiated a programme to actively involve start-ups and small companies in getting knowledge from public research institutions to the market better and faster.

complete disinvestments took place and on four occasions activities were ceased or disposed of. These businesses tended to involve knowledge developed and applied in the TNO organisation.

Finance and Operations

The consolidated turnover rose in 2005 by EUR 6.1 million to EUR 562 million (+1.1%).
This growth took place while the total number of employees fell by an average of 5%.
Owing to the reduced overhead and rise in productivity, the net turnover per employee rose by 6%.

Market turnover rose in all core areas, with the exception of TNO Quality of Life. Here, market demand was down, particularly from the food industry. Foreign market turnover rose by 3% to EUR 122 million, while the turnover in the Netherlands remained almost unchanged (EUR 244 million). The share of government funding in total turnover fell marginally in 2005 to 34.8% (2004: 35.0%).

Despite a rise in pension costs of EUR 4.5 million, the costs of personnel fell in 2005 by approximate 1%. A reduction in overheads and the number of productive employees left the total number of employees (including TNO Companies BV) at the end of 2005 at 4,648, down from 4,900 at the end of 2004. The rise in pension costs is attributable to the recovery plan put into effect in 2004, which included an increase in the pension contribution to address the problem of the pension fund's low level of coverage. Thanks in part to the rise in share prices, the pension fund's coverage had rallied at the end of 2005 to 127% based on 4% actuarial interest.

The decision to relocate much of the TNO activity in Apeldoorn in the coming years to other TNO locations necessitated an additional reserve of EUR 1.3 million over and above the reserve set aside in 2004. To fund the proposed relocation of the automotive activities from Delft to the Eindhoven region, an additional reserve of EUR 2.6 million was set aside.
To finance this concentration of knowledge in and around Eindhoven a total of EUR 16.2 million was pledged by sources in the region and by the FES. To fund the proposed construction of a nano-facility in Delft, in collaboration with the TU Delft, EUR 17.0 million in FES monies was promised.
A key aspect of these concentrations of knowledge is the effort being made to ensure that they dovetail as far as possible with university targets, whereby cooperation will be fundamental. The targets include those agreed in the 3-TU programme. The financial result benefited from incidental income of EUR 1.6 million. This derived from the successful sale of IVIGO to Tandberg.

Liquidity rose in 2005 by EUR 7 million to EUR 79 million. In the coming years a significant portion of the liquidity will be used to relocate the laboratories of TNO Defence, Security and Safety from Rijswijk and Ypenburg to Cromstrijen.
An agreement in principle will be reached with the parties involved about the funding to be provided by the various government bodies for this relocation.

In 2005 additional credit facilities were agreed with banks to the sum of EUR 50 million. The facilities take the form of five-year stand-by roll-over credit facilities and will be used, among other things, to finance the long-range investment programme and the expansion of the bank guarantee facility.

Employees

TNO wants to be an attractive employer, able to attract the potential it needs and capable of deploying its people for an extended period in a flexible, creative and market-oriented way. To this end, TNO has developed and applied instruments to encourage its employees to invest in career planning. These include an extensive management development programme as well as instruments, for use by both management and employees, that will boost employability. With respect to the latter, value momentum has been provided by the covenant agreed with the Central Works Council and the professional organisations. In this way, TNO wants to remain an attractive employer.

Another employee satisfaction survey was conducted in 2005. The results show that in general our employees are satisfied with their work at TNO: as in 2002 they awarded the organisation a mark of 7.4 (on a scale of 10). Internal communication between management and employees and trust in the organisation's leadership are points requiring attention. Improvement plans have been drawn up accordingly.

In the reporting year, 266 new employees were appointed and 555 employees left the organisation. On 31 December 2005, 4,431 employees (4,108 fte) were employed by the TNO organisation. TNO Companies BV employed 589 people (540 fte) on that date.

TNO is focusing its efforts to gradually increase its number of patented inventions.

Successful strategic collaboration begins with a thorough knowledge of our customers and their markets.

TNO company code

The year under review witnessed the development of the TNO company code that identifies the organisation's core values with respect to its employees' performance. These are integrity, independence, professionalism, social responsibility, market and customer orientation, cooperation and people awareness. While the company code was being devised, whistle-blower regulations were being developed to manage the reporting of alleged wrong doing in the organisation.

Employee participation

The effects of the reorganisation into five core areas were discussed regularly with the Central Works Council. The culture of the organisation is another topic to which a great deal of attention was paid during the year. In addition, the TNO Board of Management and the Supervisory Board talked to the Works Council about the meaning of corporate governance and the draft Strategic Plan 2007-2010. Like the Works Council, both boards recognise that the position they adopt must be transparent as must the distribution of tasks among board members. Six consultation sessions were held in 2005; one of the matters discussed was the Occupational Health and Safety policy framework. Furthermore, TNO entered into a covenant with the Works Council and the professional organisations about its employability policy. The TNO Board of Management characterised the consultation with the Works Council as 'critical in a positive manner, respectful of one another's position'.

Communication

TNO is a well-known name and the organisation has a good image. This is evident from the results of a couple of image studies that were published in 2005; one of the publishers was Incompany magazine. In studies like these, TNO tends to score in the top percentile.

However, a good name and image are no guarantee that society or our business relations will be familiar with the TNO organisation and the nature of our work. 'TNO is a concept that is insufficiently understood' was how one of our business relations put it. To address this, over the past year external communication efforts have focused on communicating in a structured and univocal manner about TNO's work and the organisation itself: giving TNO one face. Personal communication is and will remain the most important determinant of the success of these efforts.

In 2005 internal communication was used primarily to stimulate the projection of TNO as one large multidisciplinary entity. Here, too, the univocal and personal communication criteria were vital.

Quality

It is TNO's ambition to deliver high quality. Our customers decide how successful we are in achieving this. To assure quality, in 2005 while the core areas were being formed, the primary and administrative processes were harmonised throughout the organisation.

Owing to the new organisation structure implemented in 2005, new ISO certifications have become necessary. Preparations for these were made in 2005 and the audits got under way in the first quarter of 2006. The intention is that the acquisition of certificates with a standard validity of three years should lead, in time, to TNO-wide ISO certification.

The reorganisation in 2005 meant that no customer satisfaction surveys or knowledge position audits were carried out during the year. However, a Balanced Score Card was developed for TNO. This instrument for monitoring and guiding the operational management will be put to use in the course of 2006. Once experience of using it has been acquired, it will be included in the TNO annual review of 2006 as part of the new, so-called 'VBTB' indicators.

2006 and beyond

An important topic of the Strategic Plan 2007-2010 is the definition and elaboration of themes. These are the knowledge areas in which TNO wants to hold a prominent position in the coming years. These societal and economic themes have been decided in consultation with the Dutch government. The use of these themes will enable us to optimally serve not only trade and industry with our knowledge, but also government. We are developing the themes into demand-led programmes that are important to the development of society and the economy.

The creation of a single face for TNO was central to our external communication efforts in 2005.

A quarter of all first-round SME vouchers is used to acquire TNO knowledge.

The themes are:
- Public safety
- Defence
- Healthy living
- Food
- Dealing with a changing society
- Work participation and ageing
- Accessibility
- Construction and spatial development
- Living with water
- Energy (management)
- Natural and built environment
- High-tech systems, processes and materials

In conclusion

There will be major challenges in the years ahead. A number of these have already been mentioned in this review. High on our agenda is our wish to boost the impact of our work for our customers. By using the many disciplines we have in house, we can offer our customers the best we have. Internal cooperation across the boundaries of disciplines is vital because innovations tend increasingly to occur at the interfaces between disciplines. This is the approach we have chosen to reshape our organisation into an effective, efficient and flexible knowledge enterprise with sufficient financial power.

The changes that TNO has been through over the last two years have demanded a great deal of our employees. We are fully aware of that. We also know that we cannot achieve our ambitions without their dedication and effort. More than anything else, the attention we pay our employees and our trust in one another will determine whether we are successful in achieving our mission. We are well on our way and wish to thank our employees for their dedication and involvement. We also thank our customers and other business relations for the trust they have placed in us.

Delft, 15 March 2006
J.C. Huis in 't Veld M.Sc., chairman
Dr. C.M. Colijn-Hooymans
C. van Duyvendijk

TNO is an organisation founded in 1932 by law. The original TNO Act of 1930 was changed in 1985. With the government looking to gain a clear distinction in the governance relationship between itself and research institutions and the need for a number of technical modifications, an amendment to the Act was effected in May 2005.

The TNO Supervisory Board (RvT) is responsible for supervising the management of TNO, being ready to advise the TNO Board of Management (RvB). In fulfilling its duties, the RvT focuses on the interests of the organisation and thereby uses the organisation's objectives as described in the TNO Act as its guideline.

The RvT comprises a chairman and six members. Since the amendment of the Act, the Ministry for Education, Culture and Science (OCW) no longer appoints a member with a vote of recommendation in the RvT. The members of the RvT are appointed by Royal Decree for a period of five years with the possibility for reappointment for a further period. In the preceding period Professor R. Van Dam-Mieras was reappointed and J.M. Leemhuis-Stout, M.Sc., has agreed to be available for a further period as chairman. The successor to A.H.J. Risseeuw, M.Sc. who will be retiring from the board in June 2006 after two terms, will be selected from external candidates according to a predetermined profile.

In the year under review the RvT met five times, each time in the presence of the RvB. There were also two special closed meetings. In December 2005 the RvT discussed in closed session its own performance, that of its chairman and the performance of the RvB.

Since the amendment of the Act in 2005, the RvT appoints annually the accountant, making use of this authority for the first time in the year under review. The decision was taken to use the services of KPMG for 2006 and beyond.

The RvB presents the annual review and the financial statements to the RvT for its approval, after which it is presented to the Minister of OCW. In drawing up the annual statement of accounts and the annual report, TNO adheres to the guidelines laid down in the civil code and takes account of the stipulations of the TNO Act and the TNO Guidelines for Financial Reporting issued by the OCW Minister. The RvT enquired from the RvB as to the consequences of the application of the new regulations for personnel remuneration (RJ 271) for TNO as well as the key differences between the European IFRS reporting regulations and the principles now being applied for external reporting. In 2006, as in 2005, the RvT discussed the financial statements together with the accountant who drafted them.

The RvT held intensive discussions about Corporate Governance. The amendment to the Act as well as the self-initiated compliance in respect of good management were cause for the RvT to adjust its regulation. The RvT felt supported by the September 2005 report by the Netherlands Court of Audit that urged a clarification of what had been agreed in terms of external supervision of the Ministry of OCW and internal supervision by the RvT. Agreements on the provision of information by the RvB have been refined on a number of points and it has been decided to install a remuneration committee and a selection and appointment committee whose procedure is governed by regulations.

The RvT shares the opinion of the Netherlands Court of Audit that further substantiation and determination of a number of existing agreements with the Minister of OCW are necessary. A proposal concerning this would be put to the Minister early in 2006.

The RvT approved the introduction of a code of conduct and a whistle-blower regulation. TNO would also introduce at the beginning of 2006 a complaints regulation that complies with the General Administrative Law Act.

The RvB comprises three members appointed by Royal Decree for an unlimited term. The RvT determines the remuneration of the RvB members and this, as for the remuneration for the RvT, is stated publicly in the notes to the consolidated profit-and-loss account. Any additional duties of the members of the RvB that do not directly emanate from their positions are stated in the annual review.

Delft, 15 March 2006
J.M. Leemhuis-Stout, M.Sc, chairman

At many organisations it is common practice to recognise the efforts of employees whose performance has been particularly praiseworthy. Each year some tens of TNO employees are awarded a prize, are acknowledged or receive a commendation from a third party, often an international association or organisation. There are also TNO prizes that are awarded by a jury of international experts.

Name Prize – Acknowledging Organisation
Rachid Ait Yaiz KIVI NIRIA Telecommunication prize 2005 – KIVI NIRIA
Elske van den Akker membership of the De Jonge Academy – The Royal Netherlands Academy of Arts and Sciences (KNAW)
Tom Basten Casimir subsidy – Netherlands Organisation for Scientific Research (NOW)
Ruud Beerkens TNO Senior Research Fellow – International jury
Hans van den Berg TNO Senior Research Fellow – International jury
Wim Bles extension of Senior Research Fellow – International jury
Christian Bos Award of appreciation – uriname State Oil Company N.V.
Jacques van der Donck Poster Award: Best Customer Solution – ASML Technology Conference
Maaike Duistermaat, Jan van Erp and Hendrik-Jan van Veen Best Hands-On Demo Award – World Haptics
Anne-Jans Faber Descartes-Huygens prize – French government
Anton Gales Professor Geerlings medal – Netherlands Institute of Welding (NIL)
Jan van der Greef Scheele Award 2005 – Swedish Academy of Pharmaceutical Sciences
Jan van der Greef Honorary Professorship by the Chinese Academy of Sciences – Dalian Institute of Chemical Physics (DICP)
Jan van der Greef Advisory Professorship – Shanghai Jiao Tong University
Frank den Hartog and Harrie van de Vlag Best Paper Award – FITCE 2005
Joop van Hemmen extension of Senior Research Fellow – International jury
Peter Hoogeboom extension of Senior Research Fellow – International jury
Hans Keus Award for Best Contributions to the Development of NCW/NEC Theory – Battlespace Information Conference 2005
David Langley Diana prize – International jury for TNO
David Langley en Nico Pals 'Outstanding paper 2005' – European Journal of Innovation Management
Olaf Op den Camp National Friendship Award 2005 – Chinese State Administration of Foreign Experts Affairs
Belinda Smeenk first prize in essay competition – Royal Association for Marine Officers (KVMO)
Peter Steeneken Saare Medal – Grain Research Working Group
Ton Vrouwenvelder special edition of the Heron journal – Building and Construction research school

The markets; these are the twenty-seven clearly recognisable portals that give access to TNO knowledge and expertise.

Work and Employment

Under the banner 'the optimum deployment of people' TNO is dedicated to innovating in work, organisation and technology, to increasing labour participation and to improving working conditions. TNO's aim is to keep people working in ways that are healthy, safe, smart and productive. To enable people to enjoy their work. TNO is a leading international presence in the field of work and employment.

Prevention and Healthcare

Major challenges face the healthcare sector. Challenges that TNO is taking up, together with its partners. With companies, government bodies, healthcare institutions and health insurance providers, we are working to increase the quality, effectiveness and safety inherent in healthcare. In the field of prevention and healthcare, we deliver research, advisory services, testing, guidance and customised training, all of which contribute to practical and creative solutions.

Pharma

The pharmaceutical and biotech industries value TNO as an innovative partner. Together with international customers, TNO is developing new medicines. From our offices in the Netherlands, the US and Japan, we support pharmaceutical and biotech companies by providing knowledge that is ready for commercial application.

Food and Nutrition

Health, safety, quality and innovation in product and process are the major focal areas in food and nutrition. By providing consultancy and research, TNO helps companies and government bodies to realise their aims with regard to safe and healthy foods. TNO also researches and develops innovative nutritional concepts that meet market needs.

Chemistry

The chemical industry is seeking to boost its knowledge and experience. In the field of chemistry, TNO offers a wide range of expertise that can be applied throughout the chain from idea to industrial process, including safety aspects and registration. This potential is best realised in partnerships with innovative chemical companies.

Innovation Policy

Government, industry and knowledge institutions are continually revitalising their technology and innovation policy. TNO supports them in this process by providing in-depth knowledge of technologies and their applications. One of our key strengths is to facilitate in the difficult task of forming and implementing innovation policy.

Defence

TNO is a strategic partner of the Ministry of Defence, with the specific role to support the Ministry and the armed forces as an advisor, innovator and technology oracle. TNO's contribution is of increasing importance given society's need for a different, in some ways new, military force. TNO addresses subjects like military action, military resources, operational deployment and decision-making, threat and protection, education and training.

Defence Industry

Together with the defence-related industry and the SME sector, TNO is developing knowledge and products that are useful to all parts of the armed forces. We are participating in the international development of materials with, for example, our leading knowledge of radar, infrared, MMICs and missiles.

Aviation

Key factors in the design and production of new aircraft are flexibility in production processes, the use of new materials, reliability, environmental friendliness and low maintenance costs. TNO is able to support both producers and purchasers in all these areas. Whether the market in question is military or civil.

Security and Safety

In the Netherlands as elsewhere, calamities and terrorism are the drivers behind the increasing incident risk. TNO delivers knowledge and advisory services that boost public safety in the Netherlands. Sophisticated technology and process knowledge are TNO's prerequisites for this varied role that ranges from knowledge centre to think-tank, from impartial referee to certificating institute.

Maritime

The Netherlands has traditionally been a bustling centre of maritime activity. TNO applies its extensive military and civil maritime knowledge to shipbuilding, inland navigation, harbours and waterways, maritime services, offshore activities, fishing, the watersports industry and ocean shipping. The Netherlands Royal Navy also draws frequently on TNO's expertise in these areas.

Building and Construction

We collaborate with companies and suppliers in developing, preparing, constructing and managing the built environment. We have a wealth of experience in developing building materials, construction systems and building processes that move forward the parameters of performance, sustainability and safety. Our knowledge also extends to indoor climates and energy performance.

DINOshop

A great many parties depend on knowledge about the subsurface. DINOshop is the portal via which TNO provides access to all the geoscientific data it holds about the shallow and deep subsurface of the Netherlands. DINO is the Dutch acronym for Data and Information of the Subsurface of the Netherlands. The archive contains data on shallow and deep borings, groundwater data, cone penetration test data, geo-electrical measurements, results from geological, geochemical and geomechanical sample analysis, borehole measurements and seismic data.

Geological Survey of the Netherlands

Under this banner, TNO delivers geoscientific information and geoscientific research to promote the sustainable management and use of the subsurface and its natural resources. This activity constitutes the Dutch component of both the European Union's EuroGeoSurveys and of the other international networks of the public geo-institutes.

Oil and Gas

The good use of natural resources is vitally important to the society and economy of the Netherlands. To meet the ever growing demand, the nation is having to draw on small or complex reservoirs. The sustainable and economic production of these reservoirs requires extraction systems based on entirely new concepts. TNO is working in these areas for both the oil and gas industry and for the national stewards of the subsurface reserves.

Subsurface

One of the major challenges facing society is the need to ensure the safe, clean and sustainable use of the soil and water resources in delta areas. As in other low-lying coastal and delta regions of the world, the Netherlands is experiencing increasing pressure on its space above and below ground due to high population density and increasing prosperity. TNO offers government, industry and other partners the best expertise in this field to tackle this challenge.

Environment, Health and Safety

With industrial activities often harmful to the environment, TNO is creating solutions for the problems that arise because of this. The emission of environmentally damaging substances is a key area of our expertise. We know about their impact on air quality and surface water as well as on people and ecosystems. We are particularly interested in the evaluation and management of the safety and environmental risks that result from accidents with materials that are hazardous, particularly to the environment.

Traffic and Transport

Traffic and transport form the backbone of our mobile society. The issues in this field are often complex and require innovative, multidisciplinary solutions. TNO is engaged in innovative policy research and policy advisory work for government and industry. The desired outcome is an improvement in the quality and efficiency of traffic and transport systems.

Automotive

TNO is working on intelligent vehicles, clean and energy-efficient engines and on active and passive safety. We also test whether vehicles comply with national and international standards and rules, such as crashworthiness.

High-tech Equipment

This is a highly dynamic market, with both larger and smaller companies partnering with TNO to developing numerous sophisticated products, ranging from state-of-the-art measuring instruments and an assembly line for microproducts to high-quality equipment for welding on coatings. We also have a wealth of experience in mechatronic products and embedded systems.

Sports, Care and Medical Systems

Strong growth can be expected in this market in the coming years, thanks in part to longevity. In conjunction with a large number of customers, TNO is developing intelligent products tailored to the needs of users in these markets, with the measure of man at their heart. All the necessary knowledge is available in house: new materials, conductive polymers, electronics and embedded systems.

Process Industry

The Netherlands is home to a number of leading multinationals in the process industry, a field in which TNO has a great deal of relevant in-house knowledge. Areas of expertise are bioconversion and separation techniques, environmental quality and our surroundings, environment and safety risk management, and the development and optimisation of production processes. Our customers include companies in the chemical, water-related and oil and gas industries as well as producers of residual materials and users of renewable raw materials.

Space and Science Instrumentation

This is a market in which TNO has enjoyed a prominent international position for more than 30 years. We develop optical measuring instruments for a range of purposes, such as observing the earth from space. In this context, we also make the instruments used to calibrate satellites from earth. Much of our work involves international collaboration; the European Space Industry is a familiar partner. We also work for industry.

Manufacturing Industry Suppliers

This branch of industry, which is home to many SMEs, is of great importance to the Netherlands. TNO does most of its work for these suppliers via the last five markets mentioned above. Building and construction suppliers also belong to our customer base.

Telecommunication

TNO serves fixed and mobile operators, service providers in the Netherlands and abroad, telecommunication suppliers and policy-makers. For these companies ICT is a core business and tends to be regarded as an investment. TNO's activities in this field include policy, customer interaction, developing broadband and mobile services, communication infrastructures (cable, glass, copper, wireless, mobile) and optimising the quality of existing infrastructures.

ICT

TNO helps companies and institutions in various branches to innovate successfully using the latest information and communication technology. Within the ICT market, we make a distinction between the semi-public sector and the business market, which includes the SME sector. ICT vision and strategy play a key role in our propositions for these market segments, as do ICT as a means to connect with customers, Total Cost of Ownership, information security and ICT innovation such as open standards and open source.

Public Sector

The government, whether local, regional or national, is both a strategic partner and customer in almost all of TNO's markets. In addition, we recognise it as a market in its own right. Within this government market we focus on infrastructure, defence, construction and transport.

TNO in figures

Consolidated balance sheet as at 31 December 2005

after appropriation of result *(in EUR x thousand)*

		31-12-2005		31-12-2004
Fixed assets				
Intangible fixed assets	2,850		1,039	
Tangible fixed assets	205,048		209,041	
Financial fixed assets	4,448		4,408	
		212.346		214,488
Current assets				
Stocks and work in progress	-5,943		-7,523	
Receivables	103,201		102,246	
Cash	79,022		72,020	
		176,280		166,743
Total		388,626		381,231
Financed as follows:				
Equity:				
- General reserves	131,266		128,357	
- Appropriated reserves	50,024		45,062	
		181,290		173,419
Third-party interests		223		200
Investment funds equalisation account		10,822		11,845
Provisions		46,384		51,417
Long-term debt		11,600		8,687
Short-term debt		138,307		135,663
Total		388,626		381,231

Consolidated profit and loss account 2005

(in EUR x thousand)

		2005		2004
Turnover	561,906		555,815	
Other operating income	4,786		9,970	
Operating income		566,692		565,785
Direct project costs	-66,603		-64,830	
Personnel costs	-357,734		-360,640	
Depreciation intangible fixed assets	-220		-25	
Depreciation tangible fixed assets	-30,793		-29,414	
Impairment of tangible fixed assets	-2,620		-	
Other operating costs	-101,337		-107,108	
Operating costs		-559,307		-562,017
Operating result		7,385		3,768
Interest received		2,040		2,248
Interest paid		-705		-332
Result on ordinary operations before taxation		8,720		5,684
Taxation		-624		-763
Income from financial fixed assets		-239		-235
Result on ordinary operations after taxation		7,857		4,686
Third-party interests		23		-12
Result		7,880		4,674
Appropriation of result:				
Result		7,880		4,674
Additions to:				
- appropriation reserve for civil operating risks	-		-2,711	
- appropriation reserve for defence operating risks	-		-	
- appropriation reserve for new defence buildings	-5,939		-7,016	
		-5,939		-9,727
Withdrawals from:				
- appropriation reserve for civil operating risks	-		-	
- appropriation reserve for defence operating risks	-		-	
- appropriation reserve for knowledge investments	-		4,538	
- appropriation reserve for new defence buildings	977		1,365	
		977		5,903
Result after movements in appropriated reserves		2,918		850
Change in general reserve		-2,918		-850
		-		-

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TNO Quality of Life

from left to right N. Harize, Dr. F.D. Pot, Dr. C.L. Ekkers, Dr. N.J. Snoeij

Healthy food, good working conditions, healthcare, sport – these are all major influences on the quality of our daily life. That's why they are attacting increasing attention. From TNO, too: we research ways of safeguarding and improving people's health and performance.

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TNO Defense, Security and Safety

from left to right Prof. Dr. P.J. Werkhoven, G.D. Klein Baltink, C. Eberwijn M.Sc., P.A.O.G Korting M.Sc.

Public safety is becoming an increasingly important theme both inside and outside national borders. TNO's research contributes to efficient and effective armed forces, and a safer society.

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TNO Science and Industry

from left to right Dr. E.J. Sol M.Sc.,
M.Eng. J.V. Elsendoorn,
J.H.J. Mengelers M.Sc., A.J. Dalhuijsen M.Sc.

To be competitive internationally, industry has to innovate: with new products, new materials, new design and development methods. TNO helps industry take on this challenge.

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TNO Built Environment and Geosciences

from left to right P.C. van Staalduinen M.Sc.,
D.Ph. Schmidt M.Sc., Dr. M.J. van Bracht

How can we optimise and sustain use of the space that is available to us in such a densely populated country? TNO examines how that space and the built environment can be best planned, used and managed, and how to make optimal use of the natural subsurface resources.

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TNO Information and Communication Technology

from left to right L. Hoedemaker M.Sc.,
Dr. G. van Oortmerssen M.Sc., Ir. G. Bosveld M.Sc.

Make smarter use of ICT so that business and government get more of a return on their investments. TNO's research generates innovative ICT applications for operational processes and information management.

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Other information

Auditors' report

The consolidated balance sheet and profit and loss account have been derived from the financial statements of TNO for the year 2005. Our auditors issued an unqualified opinion on these financial statements in their auditors' report, dated March 15, 2006. Without qualifying their opinion, the auditors drew attention to the deficits arising under the pension scheme calculated on the basis of Guideline 271 as applied from 2005 according to the Guidelines for Annual Reporting. However, on the basis of the regulations of the Minister of Education, Culture and Science, TNO has been exempted from the application of this guideline.

Colofon

Editing and production
Corporate Communication

Text
Corporate Communication

Design
Barlock, The Hague

Printing
Den Haag offset, The Hague

Photography
Eric de Vries, The Hague

Except
Koninklijke Luchtmacht 'Better than the naked eye'
ANP foto 'Through the wall'
Onnink Grafische Communicatie BV 'Applying brain to brawn'
Politie Amsterdam-Amstelland / Nick Hogeveen 'All-inclusive portal'
Ubbink Nederland BV / Robert van Tongeren 'Room with a view'
Cees Camphuijzen 'Sensitive hearing'

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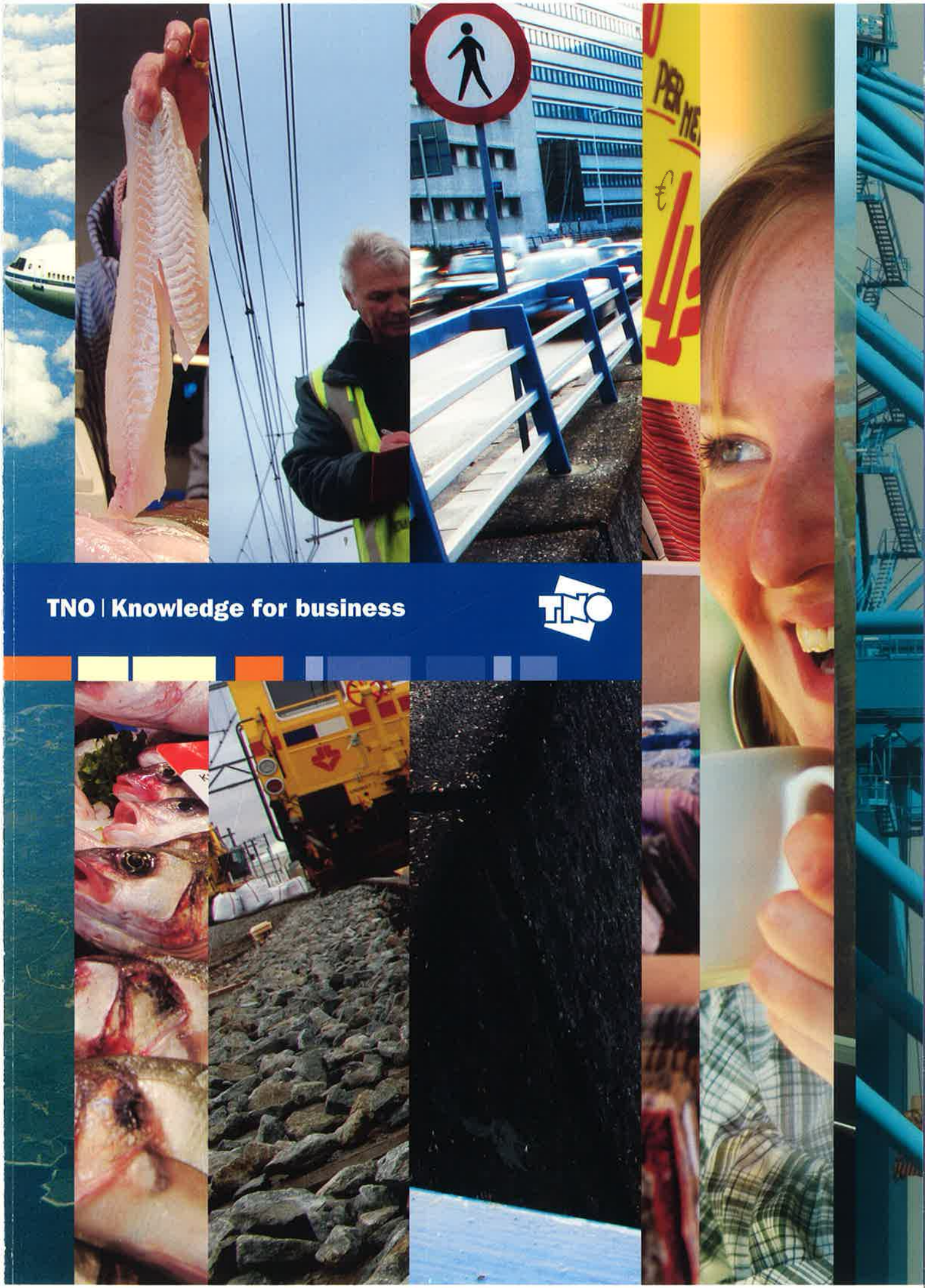
TNO | Knowledge for business
TNO

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Are you seeking a solution to a knotty problem? Would you like to know if TNO can help you If so, get in touch with the TNO Infodesk. The TNO Infodesk will put you in touch with the right person at TNO to help you. That will also give you the opportunity to experience at first hand our expertise, our enthusiasm and our dedication.

Would you like to know more? Click on tno.nl. You can request our quarterly magazine, TNO magazine, via the website. We are also happy to send you our brochures.

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Focused on people

TNO's research is focused. On virtually every conceivable aspect of human existence: from physical health to the quality of the environment in which we live and from employment to public safety. And people need products and communication resources for these things. TNO is also geared to these needs. All our research has a common denominator: making scientific knowledge applicable to boost the innovative capacity of business and government so that the products, services and solutions that businesses and government generate actually offer something that makes a difference to people. Consumers, citizens or employees – people are at the heart of everything we do.

Our work concerns five core areas:
TNO Quality of Life
TNO Defence, Security and Safety
TNO Science and Industry
TNO Built Environment and Geosciences
TNO Information and Communication Technology


TNO Flight tracker
443
sim
1 (3)
+36
START
POWER
VOLUME
OPEN
DRUKVAT
DICHT
Vne (never exceed)
6500 ft) >> 261 km/h (141 kts)
9800 ft) >> 246 km/h (133 kts)
13100 ft)>> 233 km/h (126 kts)
16400 ft)>> 221 km/h (119 kts)
19600 ft)>> 210 km/h (113 kts)
neuvresnelheid) >>>>>> 176 km/h (95 kts) bij volle belading
pen in landingstand) >> max. 150 km/h (81 kts)
COM

Aircraft vibrate. The vibrations may be caused by the engines or the wind, for example, but for the sake of comfort and safety efforts are made to reduce them. Aircraft builders are unable to identify where vibrations are likely to occur. Ecoflight, part of the Van Boekel Groep, is a company that specialises in airborne observation. Its experts wanted to know whether these vibrations were being picked up by their camera systems.

Ecoflight was also looking for a way to ensure its planes follow their flight paths as closely as possible. The more accurate the adherence to the flight path, the better the quality of the camera images. To gain an answer to these questions Ecoflight submitted a Knowledge Voucher issued by the Ministry of Economic Affairs to TNO.

Sensors were fitted in various spots of the aircraft's interior to measure the vibrations. TNO then used a computerised method to measure the vibrations during take-off, cruising and landing. The vibrations were shown to be within permissible limits.

To help pilots follow the designated route accurately, TNO developed new functionality around their existing GPS system, coined the Flight Tracker. It comprises a software application in combination with a small screen that is placed in front of the pilot.

Ecoflight can now rest assured that its onboard camera system is functioning as it should, and pilots can see clearly whether they are flying within the lines of the flight path and take corrective action if necessary.

Into the future with ARNO

Congested roads and no alternative routes – Dutch road traffic is heading for gridlock. In response to the Dutch Ministry of Transport, Public Works and WaterManagement's Transport Research Centre, TNO has developed a tool for designing the regional road network of the future. ARNO (Architecture for Regional Network Development) is a design process that identifies the infrastructural projects necessary to keep a region's traffic moving in the future.

Working on a regional basis and one step at a time, ARNO translates general policy principles and ambitions into the desired future road network, its functionality and structure. In some cases the design suggestions are so radical that their political acceptance may take some time. ARNO offers other insights too. It can study 'quick wins' – quick, feasible, cheap measures to solve a current traffic or transport problem – and determine whether they will be detrimental or positive over the longer term.

The ARNO methodology has already been used in various pilots. In Utrecht one such pilot resulted in a follow-up assignment in which ARNO was used to visualise the ideal configuration of the road network around Utrecht in 2020. The ARNO philosophy has also been applied in a study for Regio Randstad, an administrative regional network whose aim is to strengthen the international competitiveness and quality of life in the Randstad, the western conurbation in the Netherlands.

A vision of a region's future isn't something that can be drawn up single-handedly. All the regional partners must be involved in developing a functional, sustainable regional network. ARNO's role is to provide them with a useful framework.

Determining risk as best as possible

At present the law recognises just one protection regime in the removal of asbestos. No distinction is made between the various activities involved and their associated risks. This means that a company has to take the same, often expensive, measures whether the situation it is handling is high or low risk and whether or not the measures are really warranted.

In partnership with DHV, and on behalf of the Ministry of Social Affairs and Employment, TNO investigated whether the rules governing asbestos-related work could be tailored to the risks involved. The study comes in response to a change in the European guideline, which now prescribes a more risk-oriented approach.

Many companies find the current regulations inhibiting and insufficiently relevant to the situation. The TNO study has revealed that the risks involved in working with asbestos fall into three categories. The lowest level of risk is incurred in the straightforward and routine removal of a solid asbestos material that doesn't involve breaking the material. This activity releases hardly any asbestos and warrants only limited measures, according to the researchers. The next level of risk involves activities in which asbestos material can easily break. The current rules are appropriate for this level of risk. The highest level of risk is incurred in activities in which large quantities of asbestos fibres may be released and in which there is a strong likelihood of residual contamination (e.g. asbestos spraying). It would be appropriate to introduce additional safety regulations for work involving this level of risk.

The ministry will implement the findings in legislation and regulations later in 2006.

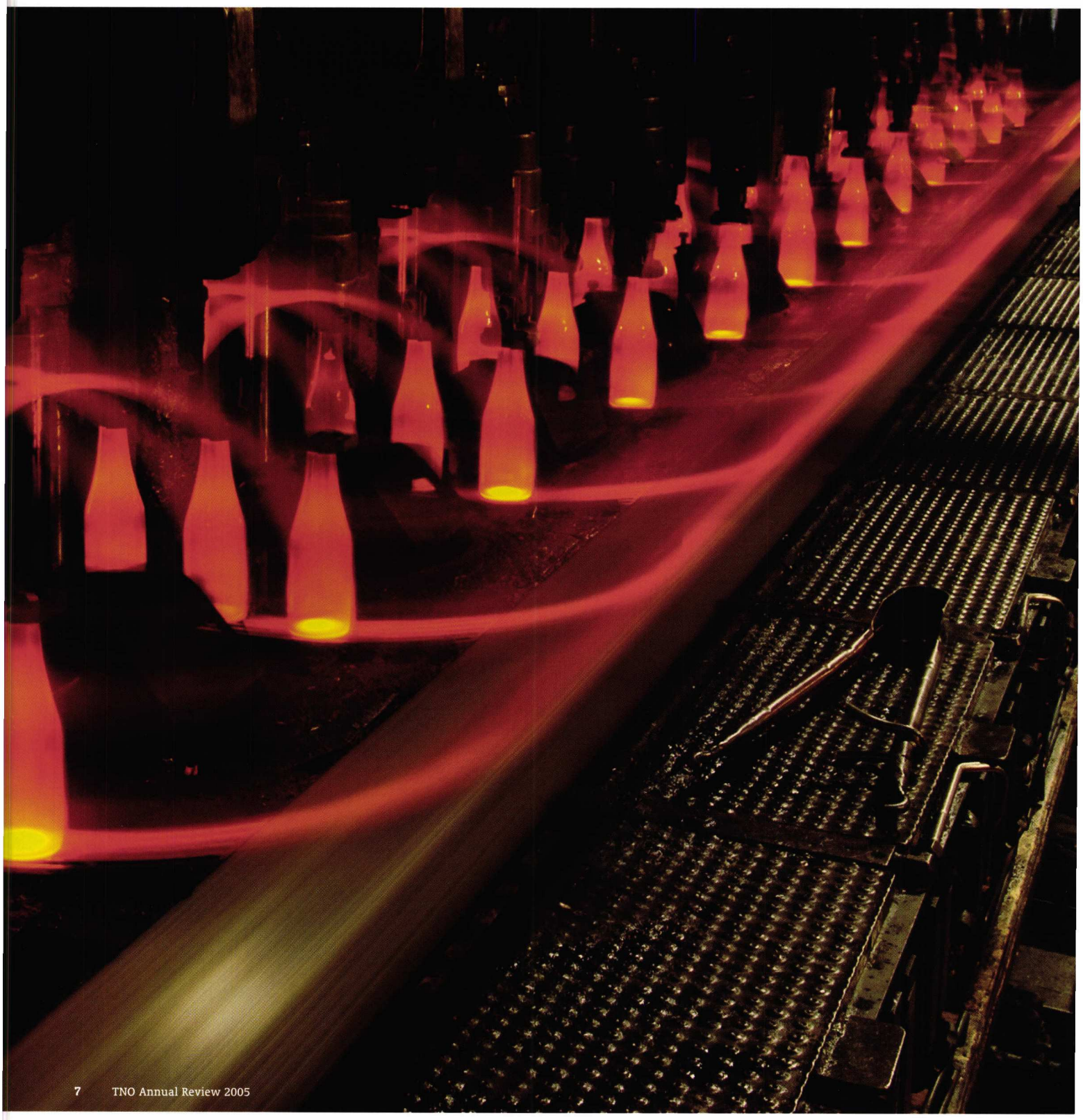
Crystal clear

People have been making glass for more than 5,000 years. Still, much remains unknown about the physical and chemical processes that take place in modern glass melting furnaces. The process in a glass oven is highly inaccessible, given that the operating temperature is between 1,500 and 1,600^{o}C. The liquid glass – glass smelt – in industrial furnaces is held in a basin, the size of a swimming pool typically surrounded by a metre high wall. The high temperature and flows in the basin result in a homogeneous glass smelt. A glass furnace of this type is operational for 10 to 15 years and throughout its lifetime it must be kept at this high temperature. TNO is developing simulation models (GTM-X) designed to describe, as far as possible, the processes in glass furnaces – these processes include the heat transfer from the flames to the smelt and the heat distribution in the smelt, as well as the chemical changes in the glass and the creation of bubble-free glass. These TNO models are used all over the world to describe, control and optimise the processes in glass furnaces as well as to design new glass furnaces.

For one glass container manufacturer in southern Europe, TNO collaborated with IPCOS to develop a glass furnace process controller based on the TNO GTM-X simulation glass furnace model. Our customer enjoyed considerable energy savings thanks to this innovation. The TNO model, on the other hand, affords greater insight into the production process, and using this information glass producers can achieve a demonstrable improvement in glass quality.

Traffic safety and ride comfort both benefit from an even, level road. And, of course, roads that don't subside or remain even require less maintenance. If you are going to build roads that can remain flat for a long time, you need knowledge of the subsurface. That goes for both the Department of Transport and Public Works and the subcontractors who are given the assignment to build the roads and have to make an estimate of the financial and technical risks on the basis of that knowledge.

The data available up till now have frequently been inadequate in describing the variations of the subsurface characteristics, resulting in a lack of understanding in the differential settlements that will occur. TNO has been working together with GeoDelft to investigate the influence of that subsurface variation on the road subsidence. It is a project that has been carried out in the context of the Delft Cluster study 'Constant Level Roads'. But we're not there yet. The coming years will see studies into the amount of soil necessary to enable sufficiently accurate predictions to be made. And we will also have to find out what kind of measurement data have to be used to improve the predictions of the settlement behaviour of the roads.



Better than the naked eye

The air-to-air refuelling of F-16s required a new vision system that offered speed and safety. The current equipment was too old and there was some doubt about its long-term reliability.

TNO partnered with the Royal Netherlands Air Force to form a multidisciplinary team to get the job done. The team consisted of experts in observation systems, behaviour, training and performance, lightweight constructions and electromagnetic radiation. Thanks to the efforts of this team and a number of carefully selected partners (Adimec, ARVOO and KLM), the air force will be getting a vision system fit for the future. The new system is a vast improvement on the old one. Its components are easy to replace and the air force will be able to do the maintenance in house.

The system's cameras work whether they are facing pitch black or looking directly into the sun. They record the aircraft being refuelled and the images sent to the operator's screen give a perfect, 3D view of events. All the relevant details and safety margins are evident. By relying on cameras rather than the naked eye, this system is at least three times better than the systems of other air forces.

Just as important as the technical advances, is the step forward afforded by the cooperation between the project partners – the Ministry of Defence, TNO, ARVOO, Adimec and KLM – who fitted the new equipment. These partners are now in a long-term cooperative arrangement that is very important for the Netherlands' international competitiveness. If this unique product can be sold abroad, the Netherlands' good name will benefit and jobs will be created.

Lab-on-a-chip

The presence of the Legionella bacteria in a water supply system endangers public health, so it is vital that the bacteria be detected rapidly. Working with the Vitens water company and the Kennemerland regional laboratory, TNO has developed a prototype of a chip with which the presence of Legionella in water can be established.

This invention is groundbreaking because it is the first and only method in the world to detect the presence and virulence of Legionella in water within one day and in one go. Previously it took 10 to 13 days to issue a definitive result as to the presence of Legionella bacteria. This result included neither the virulence nor the status. The chip, commonly called the 'lab-on-a-chip', applies new knowledge about the Legionella DNA. A prototype is already available. Researchers are currently hard at work on making the invention practicable. The 'lab-on-a-chip' is expected to become commercially available in spring 2007. Since 2004, Vitens, TNO and the Kennemerland regional laboratory have been clustering their knowledge of Legionella in drinking water: practical knowledge about drinking water infrastructure, sampling, the development of new microbiological analysis techniques based on new DNA technology and the role of drinking water. The results of this development will ultimately benefit patient care.

Through the wall

A gadget for looking through walls. Useful for SWAT teams about to storm a building, for fire-fighters looking for survivors in a burning house and for the army when on patrol in an urban area. TNO's radar specialists have developed a prototype of what is known as through-the-wall radar: a radar able to see through a series of walls simultaneously.

This equipment indicates whether there is life behind a wall and how many entities are involved. As well as whether they are sitting or pacing back and forth. And even if their heartbeat and breathing are calm or fast. In short, the location and number of victims, hostages and terrorists. This through-the-wall radar has some remarkable features. Firstly, it works with low levels of radiation, in compliance with regulations. What's more, it works at a distance of 10 to 20 metres from the wall. Competing systems typically need to be placed up against the wall or use substantial levels of radiation. Its weight and size are also handy. It is no bigger or heavier than a briefcase. Discussion about the equipment's final form and about production in 2006 are in full swing. It goes without saying that the sale and use of this equipment will be strictly regulated.

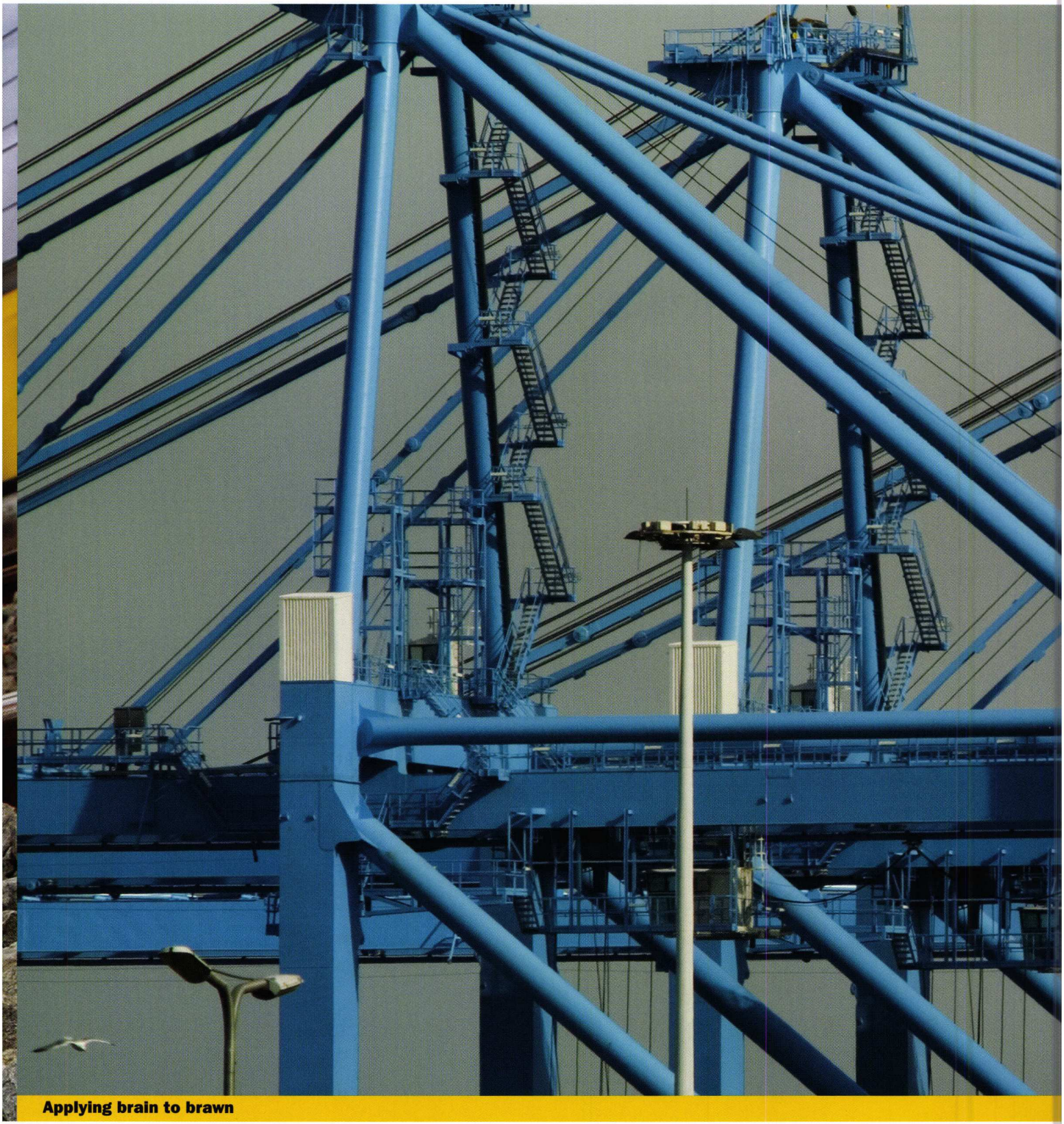
Steaming ahead!

The new Dutch Occupational Health and Safety Act prohibits the inspection on foot of railway switches while the track is in use. After all, a train could appear unexpectedly. But halting train traffic is not a viable alternative in the eyes of the millions of passengers using the Dutch railways. What was needed was an automated switch inspection. TNO has designed just such a system: aerial video recordings combined with detailed recordings of the side of the rails offer the same guarantee of safety as the classic method of inspection on foot. This new approach makes switch inspection safer and, if you consider the economic benefit of not disrupting train services, the automatic method represents a cost savings.

Like the switches, the rails also need regular checks. Test trains are used for this task. TNO has been working for Eurailscout, a renowned inspection organisation for rail infrastructure, since the 1970s.

For the latest ultrasonic UST 02 test train, TNO developed the necessary electronics, software and hardware. Computer software, for example, provides the operator with the optimum support when classifying the defects. This approach has accelerated the data processing and made it easier to estimate maintenance and repair costs.
In addition, an accurate indication of operational safety is now possible. The test train can travel throughout Europe and is much more efficient than its predecessor thanks to its higher cruising speed of 100 km per hour. Not only is the inspection of cracks and fractures steaming ahead, but train disruptions are kept to a minimum, and that's even more important.

Thanks to the intelligent signal processing and the smarter interpretation of data with which TNO has equipped UST 02, Eurailscout is now able to report on a day's activities within 24 hours. This high-speed reporting also applies to serious defects: an important distinction from the competition.



Applying brain to brawn

In armed conflict, the mental component is at least as important as the physical. PSYOPS, or psychological operations, is a unique weapon that has been used for centuries to wage war and secure victory.

Today, our armed forces use PSYOPS to try to break the will to fight of enemy forces and to build cooperation among the civilian population caught in the field of operations. PSYOPS is also an important weapon in the fight against terrorism: if we know the psychological effects terrorists are trying to achieve, we can work out ways to counteract them. Behavioural scientists at TNO are studying how our armed forces use PSYOPS as they go about their work. PSYOPS should not be deployed hastily. It is a complex weapon and it is vital to have feedback on the effect being achieved and how the weapon's efficacy can be improved.

TNO is using its expertise at both strategic and tactical levels. Research carried out by TNO has already delivered a number of practical products such as a PSYOPS deployment manual, an instrument with which to measure the tactical effects and a method for categorising PSYOPS activities in terms of their severity.

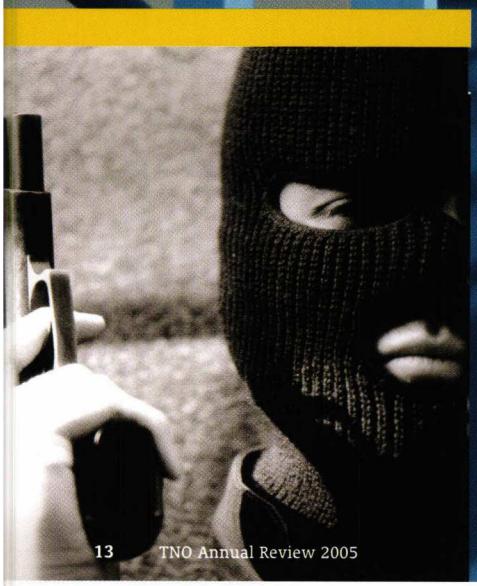
Sitting pretty

Innovation is the basis of the competitiveness of Dutch manufacturing. We can't compete in terms of price with countries like China. The key to our success must continue to lie in smart development.

Working with Merford Cabins, TNO has developed an ergonomic workplace for crane operators. Historically, Merford Cabins is a steel-processing company, but today its focus is on ergonomic work environments that safeguard the worker's health and well-being, enabling him or her to perform work tasks better and more efficiently.

The Ergoseat has many advantages. It gives the user good visibility, provides comfort and enhances the work environment. It also ensures that users adopt a healthy position while sitting. The Ergoseat has achieved worldwide success, thanks to the combination of TNO's expert knowledge and Dutch business sense. The operating cabins equipped with Ergoseat are being used by the Chinese world market leader in dockside cranes. Their product is sold and used all over the world, including the Netherlands.

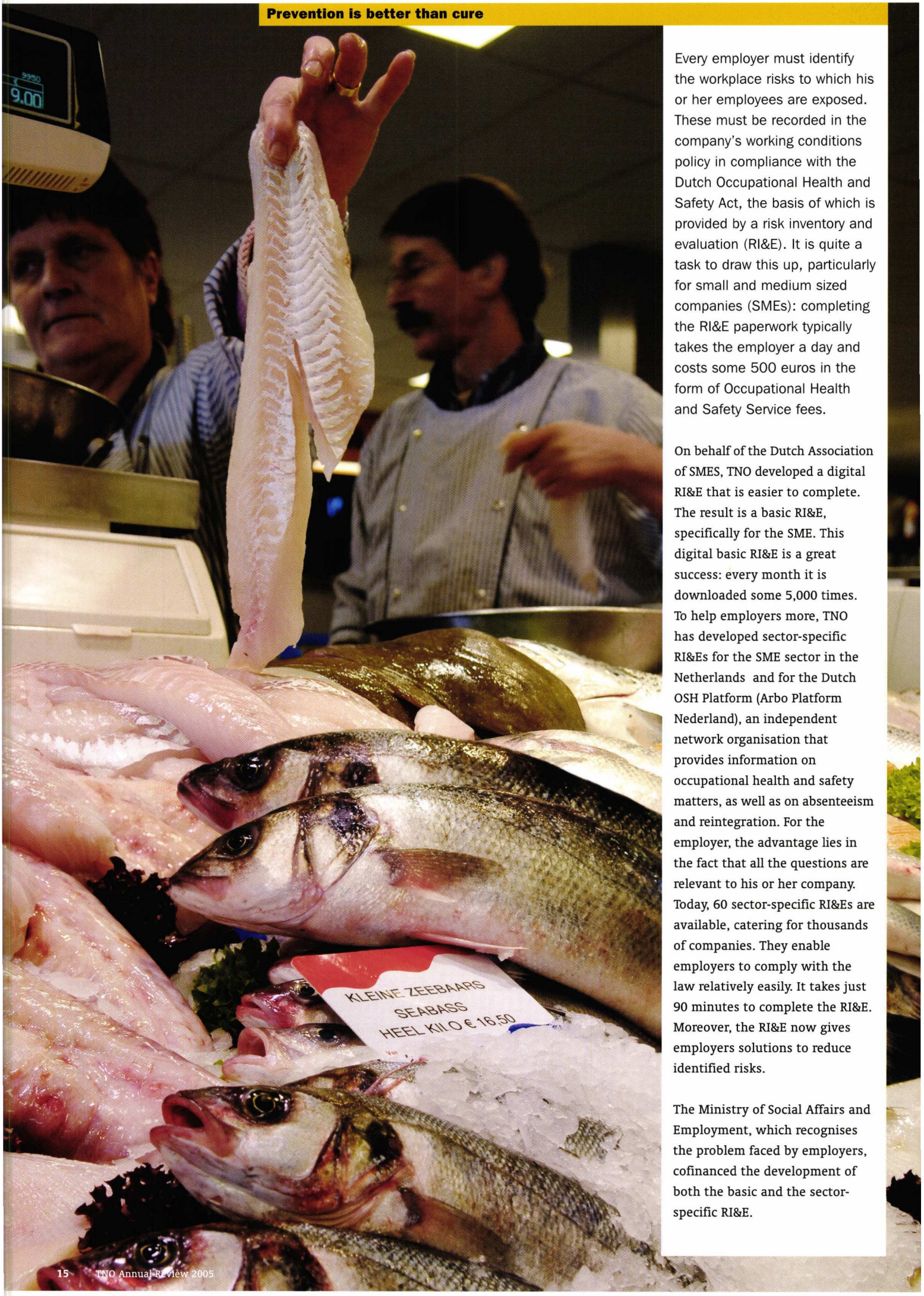
Innovations such as these have both an economic and a social impact: the improved posture and working environment have reduced the crane operator's chance of back disorders by 50 per cent. Similarly, a study at the port of Antwerp has shown that the amount of general sick leave taken by crane operators has fallen too, by almost 50 per cent.



Digital Telephony

Together with price and service, a stable network is an essential feature for consumers of telecommunication services. Before launching digital telephony commercially Casema wanted to be sure that its network had sufficient availability i.e. the percentage of time that a connection works. Over a ten-day period TNO calculated the average availability of Casema's network for digital telephony. The results were positive. Nothing stood between Casema and the launch of its digital telephony in June 2005.

TNO then looked at the quality of the network; Average availability alone doesn't always tell the full story. TNO calculated the availability for 10, 50 and 90 per cent of Casema's customers. In addition, this calculation revealed where investment in the network was genuinely leading to higher availability and where not. TNO then applied its generic system to make calculations of a similar nature for all of Casema's other cable services.
Finally, TNO advised Casema to set its sights on keeping the disruption resolution time as short as possible. One disruption lasting a day and a half is just as disastrous for the availability as ten disruptions that are resolved within a couple of hours. TNO's unique knowledge of digital networks helped Casema to organise its services in the best possible way. And that benefits Casema's customers.



Every employer must identify the workplace risks to which his or her employees are exposed. These must be recorded in the company's working conditions policy in compliance with the Dutch Occupational Health and Safety Act, the basis of which is provided by a risk inventory and evaluation (RI&E). It is quite a task to draw this up, particularly for small and medium sized companies (SMEs): completing the RI&E paperwork typically takes the employer a day and costs some 500 euros in the form of Occupational Health and Safety Service fees.

On behalf of the Dutch Association of SMES, TNO developed a digital RI&E that is easier to complete. The result is a basic RI&E, specifically for the SME. This digital basic RI&E is a great success: every month it is downloaded some 5,000 times. To help employers more, TNO has developed sector-specific RI&Es for the SME sector in the Netherlands and for the Dutch OSH Platform (Arbo Platform Nederland), an independent network organisation that provides information on occupational health and safety matters, as well as on absenteeism and reintegration. For the employer, the advantage lies in the fact that all the questions are relevant to his or her company. Today, 60 sector-specific RI&Es are available, catering for thousands of companies. They enable employers to comply with the law relatively easily. It takes just 90 minutes to complete the RI&E. Moreover, the RI&E now gives employers solutions to reduce identified risks.

The Ministry of Social Affairs and Employment, which recognises the problem faced by employers, cofinanced the development of both the basic and the sector-specific RI&E.

Chinese experium

Huawei, the Chinese supplier of mobile and fixed networks is rapidly starting to develop the European market. The company, founded at the end of the 1980s, is best known in the Netherlands for being the supplier of Telfort's HSDPA network, the swift successor to UMTS/3G. Huawei Technologies Nederland found a valued partner in TNO.

The first product of this partnership is the showcase room of the Mobile Innovation Center in Amsterdam. In this showroom Huawei can demonstrate their new products and services. Huawei targets the business market and, as an extension of that, the end customers. Instead of a traditional setting, the choice was made to create a so called 'experium': a room in which the services can be experienced personally.
In this experium the opportunities are presented that the new technologies offer to the customers in their daily life. In the experium Huawei's customers can experience the different services as part of the presentations. TNO has drawn up realistic examples. For the business market TNO has realised a story about water management and how mobile technology can be of help and improve efficiency. For the consumer market TNO developed the happy holiday story about a family on holiday that uses mobile technology in all possible ways for entertainment and communication.

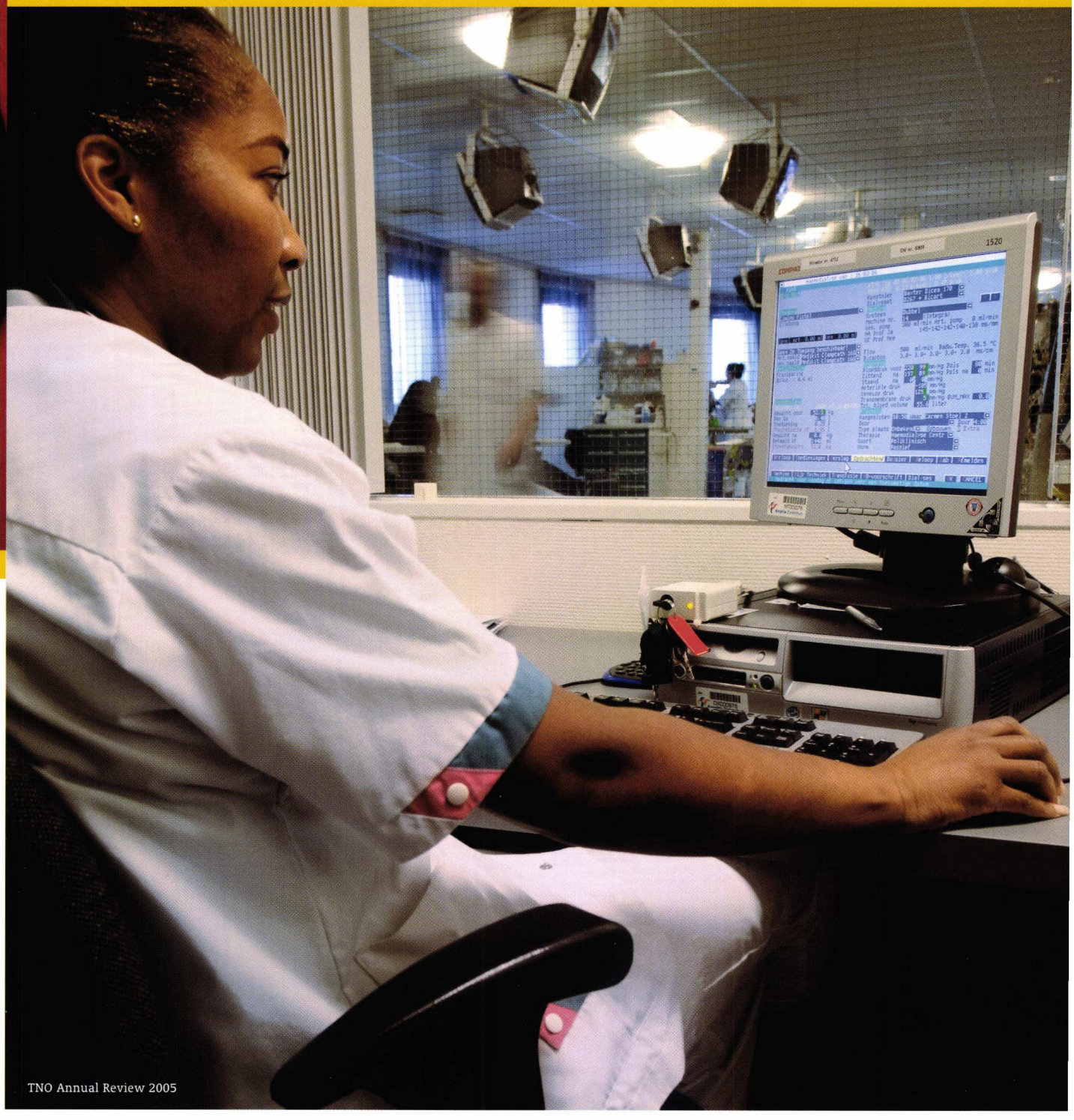
Safe in hospital

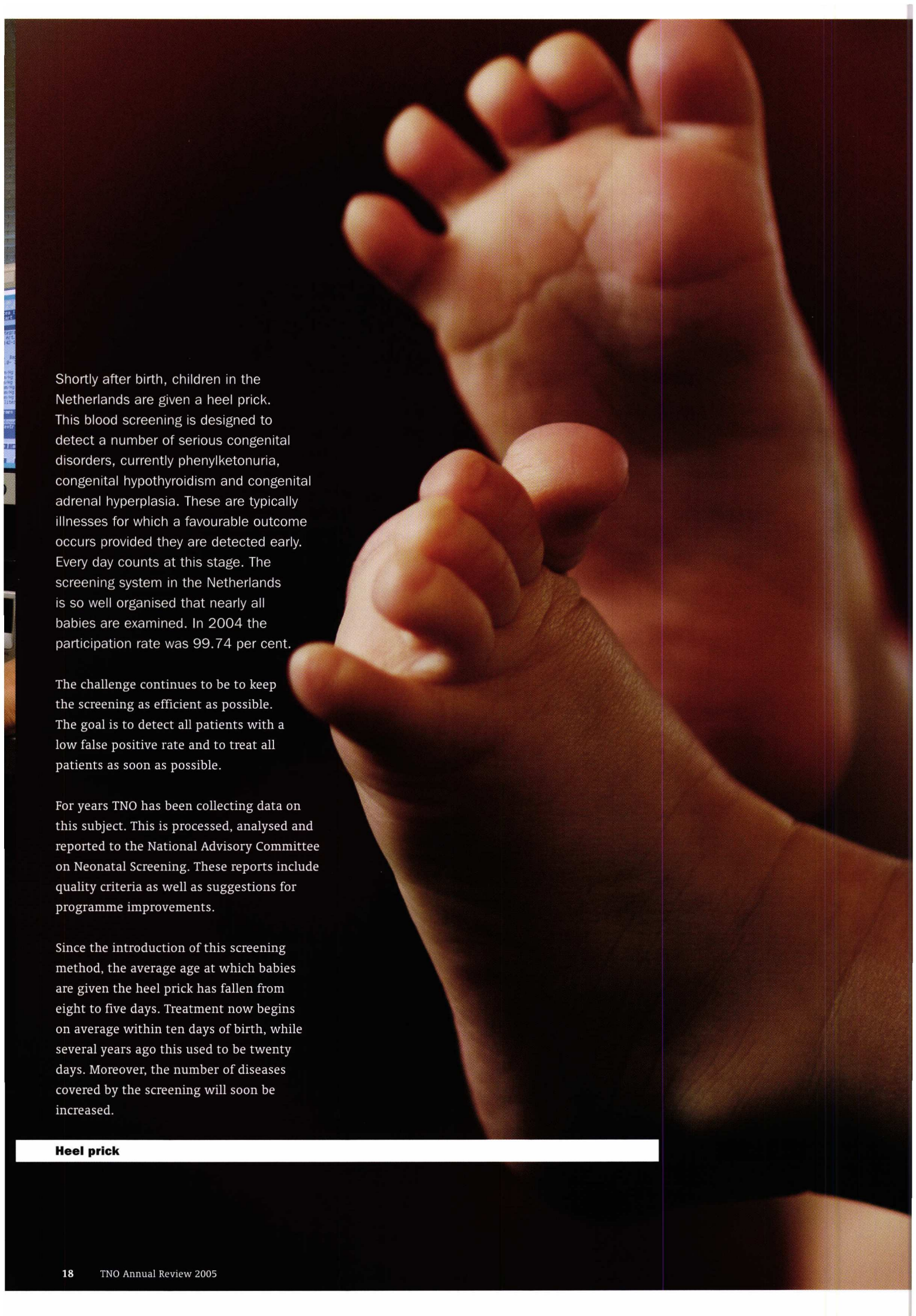
The top priority in the healthcare sector is the provision of care. Information security, whether it's a question of a piece of paper or a complete electronic dossier, is considered less important.

Meanwhile, the need to transfer information in the healthcare sector is growing – between healthcare providers and from one location to another. Patient details are increasingly being digitalised. In view of these developments, it is necessary to review the issue of security: hackers recently showed that breaking into patient files is child's play. In response, the government is now requiring the healthcare sector, from GPs to hospitals, to implement NEN standard 7510. TNO was one of the parties that developed this standard. The Amphia hospital in the Dutch city of Breda called in TNO when it needed an information security system.

Together, the partners carried out a Security Quickscan and examined some 70 applications and information flows, with risk analysis carried out on the twelve most patient-critical flows of information. These varied from the Amphia network to the archived hardcopy patient files. The team focused its attention first and foremost on the consequences of the non-availability of information, digital or otherwise, for patients and the organisation. In addition, TNO drew up a Quickwin list of issues that Amphia should and can address as quickly as possible.

Thanks in part to TNO's study, information security has been given the attention it warrants throughout the Amphia organisation. An information security organisation is being set up and deployed in phases, putting Amphia ahead of the field.





Shortly after birth, children in the Netherlands are given a heel prick. This blood screening is designed to detect a number of serious congenital disorders, currently phenylketonuria, congenital hypothyroidism and congenital adrenal hyperplasia. These are typically illnesses for which a favourable outcome occurs provided they are detected early. Every day counts at this stage. The screening system in the Netherlands is so well organised that nearly all babies are examined. In 2004 the participation rate was 99.74 per cent.

The challenge continues to be to keep the screening as efficient as possible. The goal is to detect all patients with a low false positive rate and to treat all patients as soon as possible.

For years TNO has been collecting data on this subject. This is processed, analysed and reported to the National Advisory Committee on Neonatal Screening. These reports include quality criteria as well as suggestions for programme improvements.

Since the introduction of this screening method, the average age at which babies are given the heel prick has fallen from eight to five days. Treatment now begins on average within ten days of birth, while several years ago this used to be twenty days. Moreover, the number of diseases covered by the screening will soon be increased.

Heel prick

Anyone for coffee?

Bravilor Bonamat is a specialist in the development, manufacture and sale of coffee-making equipment for the professional market. With about 200 employees the company produces about 100,000 coffee-makers each year in a wide range of models. Together with TNO Bravilor developed a new assembly line for one of its product families, with special attention to the flow and flexibility of the work process and the ergonomics of the workplaces.

This project required specialists in demand flow assembly, work productivity and ergonomics. TNO has these specialists: our ability to combine 'people' knowledge with 'production' knowledge is unmatched.

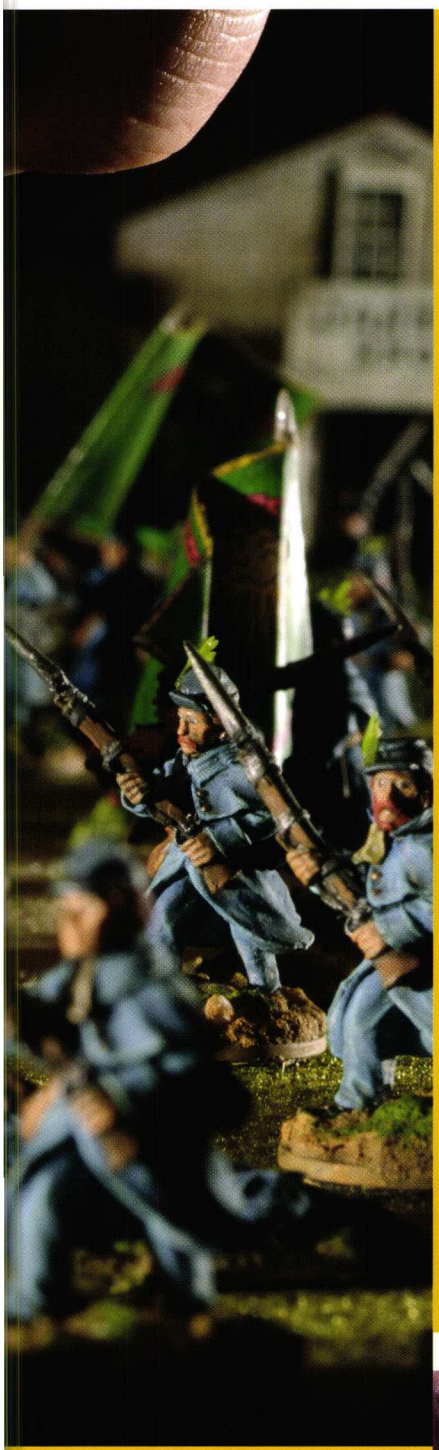
Thanks to close cooperation between TNO, Bravilor and the suppliers of the assembly equipment, within four months the company's four original assembly lines in Heerhugowaard had been replaced by one new mix model assembly line. The benefits are wide-ranging; productivity is expected to rise considerably, less storage space will be needed, costs will diminish and working conditions will improve.

Equipped for the future

The army operates in a world in which changes come in quick succession. Units are unremittingly deployed in one foreign operation after the next, all round the globe. It is almost impossible to keep up with technological developments in the field of weapons, operational deployment and logistics. What the army should be like in 15 years' time is almost anybody's guess. The army needed a vision of its future and called in TNO to help. This strategic partnership resulted in a programme comprising four work packages: KL 2020.

The various work packages have clarified a number of issues for the army. How do our most important allies and countries similar to the Netherlands handle strategic policy choices? Which weapon systems and other resources should the army purchase, and in what mix, to achieve optimum return in a range of situations? What are the investment priorities? What, in other words, are the alternatives for the army's future force? What will the future technological developments be? How do you write the policy study that must lead to a vision of the future?

The results of the various work packages provided the army with an international frame of reference and have made the vision of the army in the future a lot more realistic. Thanks to the overviews, analysis, advice and practical suggestions offered by TNO, the army can now equip itself better to face the future.



Since the late 1990s, ECO Ceramics has been producing burner systems for a wide range of industries. These systems are based on ceramic foam burners. The company also supplies ceramic infrared burners suitable for industrial textile-drying. Some time ago, ECO Ceramics foresaw a market for a complete drying system that would deliver the textile industry significant energy savings. Besides saving energy, the system was required to accelerate the textile production process and improve product quality.

TNO's expertise in the field of textile technology dates back more than 80 years. Reason enough for ECO Ceramics to work with TNO to develop such a drying system. As early as the on-site test phase, the response from the sector was enthusiastic.
Since then, ECO Ceramics has sold a number of textile-drying machines in the Netherlands and seen its turnover increase. Interest is also being expressed in Asia and Germany.

But that's not the end of the story. Plans are afoot for continued process integration: to combine the textile finishing, drying and fixing in one step. That will bring even greater energy savings and further accelerate production.

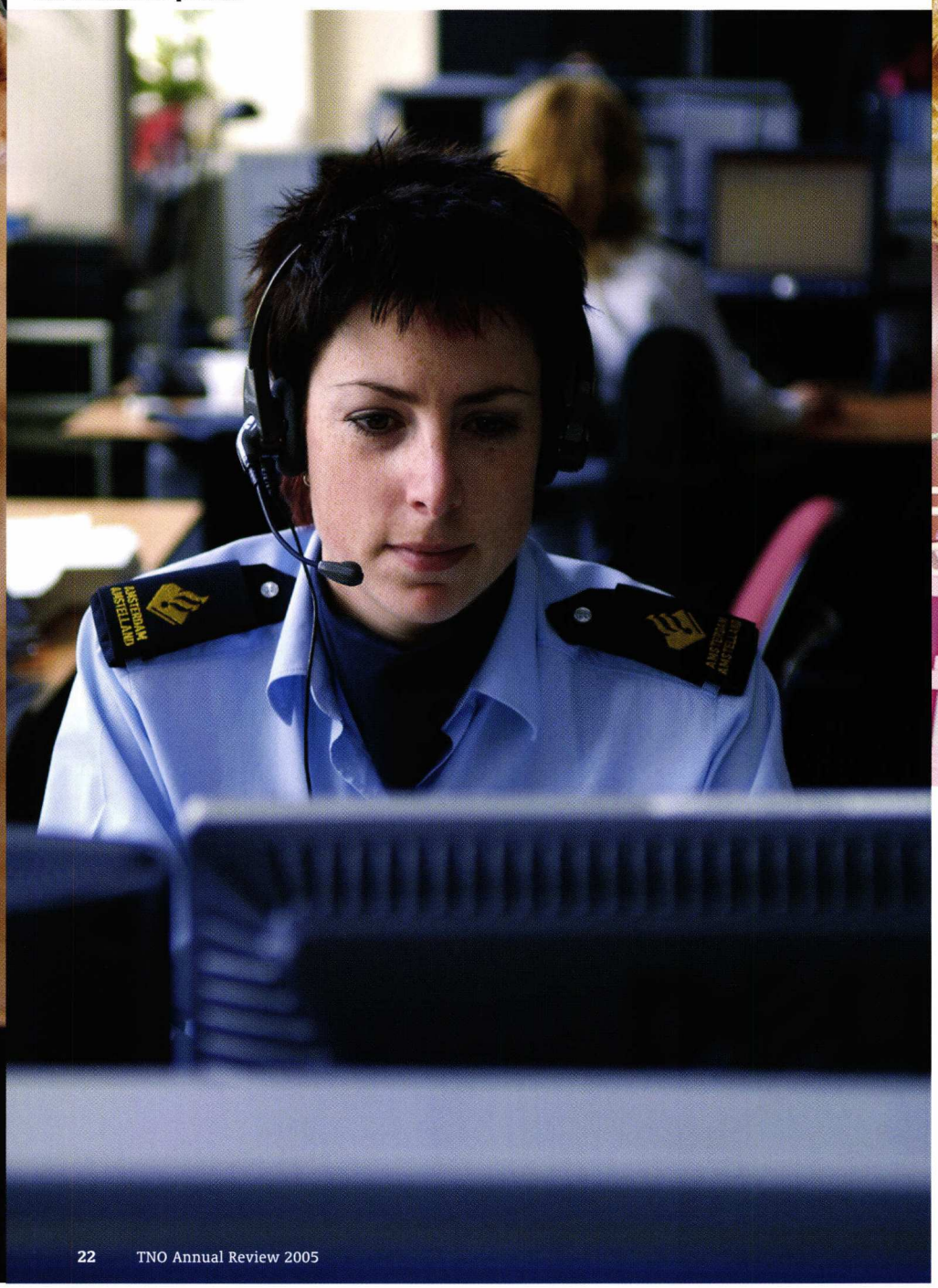
Bone dry

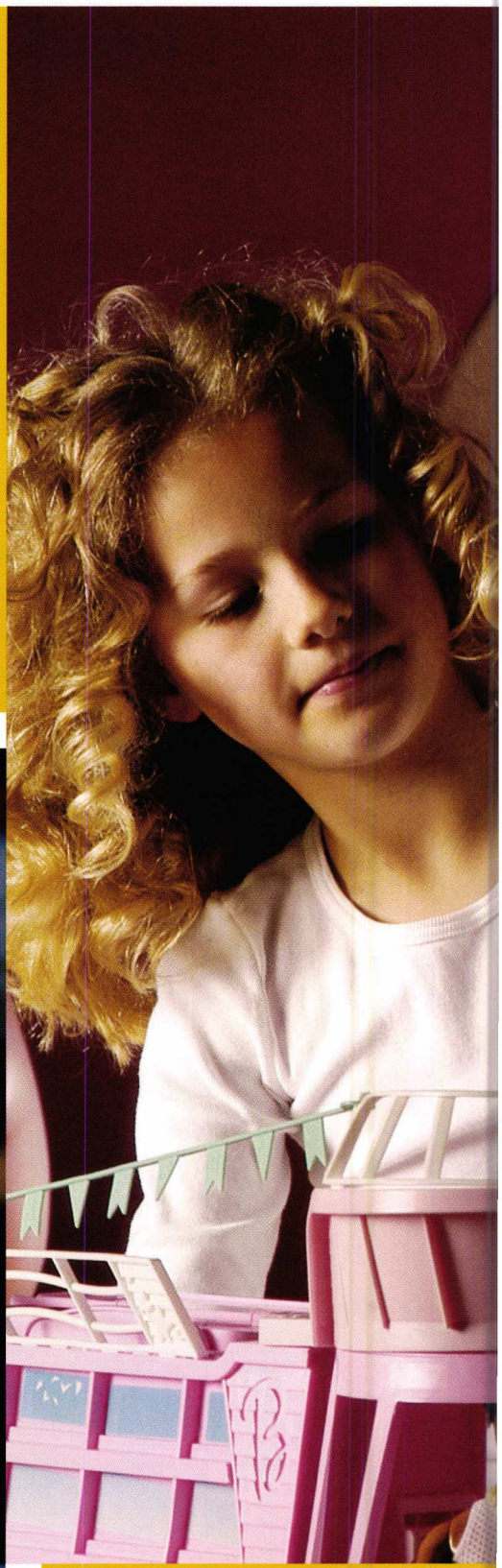
Various divisions of the police force use open sources in their detective work. As yet, only a small part of this type of desk research has been automated. Some sources, like magazines, are still available only on paper. Other sources, like TV and radio broadcasts are neither archived nor itemised in official records.

Now TNO is changing that situation. For the Amsterdam-Amstelland police force, TNO has developed a system called Novalist. This is an all-inclusive portal to sources of information that could be of interest to the police. The sources in question are on the internet, in newspapers and magazines, and in television programmes. They are made accessible to the police through a combination of automatic file formation and multimedia analysis. This means that information on one particular topic is channelled to a single file that is labelled appropriately with 'metadata'. The advantage for police users is that the collation of information has been done for them. Their own search for relevant information is now quicker and more efficient.

This was confirmed during the system pilot held at the police department unit responsible for financial-economic investigation. A preliminary inquiry into a suspect was carried out afresh using the system. A number of relevant television broadcasts were found that had earlier been missed and, moreover, the inquiry took considerably less time than it had first time around. Experts are now working out the details about how Novalist can be incorporated into the police force's new national information architecture.

All-inclusive portal





Sensitive hearing

Room with a view

Its creative range of plastics products has made Ubbink Nederland BV a market leader in a number of niche markets in the building sector. TNO support to Ubbink goes back a long way, assisting with various industrial product concepts. An example is a modular, plastic dormer window that came out of a strategic brainstorming session with Ubbink which TNO initiated and facilitated in 2003. The company was seeking ideas for getting more out of the space under a pitched roof. After all, if you are looking for somewhere to build, you won't find anywhere cheaper!

The brainstorming between Ubbink and TNO generated a great many product ideas. Two of these were selected, both innovative and capable of development within a year. TNO remained involved as both the Paris and the Milano took shape. The first is a round shaped dormer window that by night is lit to simulate moonlight while the latter is a dormer window unit that comes complete with self-cleaning glass and built-in sunscreens. Thanks in part to the strategic and construction advice offered by TNO, both products were on the market within two years of the brainstorming session.

TNO continues to offer this SME company its services as an advisor on business and product development.

Sonar and seismic equipment are used not only by naval and fishing vessels but also by oil companies. They have a wide range of uses. However, the noise generated by this equipment may interfere with the orientation and communication of whales, dolphins and other marine mammals that depend almost exclusively on their hearing to orient themselves and to find food.

The Royal Netherlands Navy is keen to minimise the disruption caused to marine life and to do its job without causing harm to nature. To help them do this, TNO has investigated the frequencies and noise levels to which marine mammals are sensitive. The data were processed in a software tool together with information about the various species, their auditory systems and their habitats. This tool is helping the navy to plan its sonar activities. TNO also developed an acoustic system for the passive detection of marine mammals. When the detection system or a human observer spots certain animals during a naval exercise, the software can stipulate the measures required to prevent harm.

The first version of the system will undergo navy trials in 2006. The system will help the navy to take account of vulnerable animals during its operations.