RFID technology temporarily as a test in the hope of facilitating incoming goods inspection and speeding up commissioning. With the implementation of RFID technology, and in particular the implementation of tags, the production and finishing process of items of clothing is particularly relevant. For this reason, tests in this regard were conducted in the Bangladesh production site to clarify at which points along the production process which transponders must be integrated and where and what kind to achieve a higher read rate. Also to be investigated was to what extent the operative production processes, if they concern the transponders directly (e.g. in sewing processes), will affect its functionality. Of particular interest was the influence of various media on the tags that are affected by refinement, conditioning and cleaning processes. Also to investigate was how and to what extent packaging and transporting processes can affect the tags. Besides influences on the mobile data carriers, it had also to be analysed what could have led to a possible failure of the respective application - as long as a detailed declaration was possible. The tests were verified in laboratory examinations at FLog. After four weeks of ocean transport, the shipping units put together in Bangladesh arrived at Ospig Textil GmbH & Co. in Bremen and were put to various functionality tests in the incoming goods area.

The result of the tests in Bremen and Bangladesh was that the different transponder types survived the loads that regularly come about in production and transport each to a different extent. While the hard-packed transponders withstood all environmental conditions, the textile Smart Labels and the Clear Disks demonstrated distinct weaknesses in individual areas (e.g. loads from washing and stone processes). So the RFID producers are under demand to develop transponders that can withstand all loads that arise during the production processes for textiles. Furthermore, their integration must not have any negative impact on the comfort of wearing of the clothes. This is a conflict of goals that sadly has not yet been resolved.
With the help of the pilot projects lead by Flog, it could be ascertained that RFID technology can be drawn upon in many areas of logistics for optimising all kinds of processes and that it brings considerable potential for rationalisation with it. Nevertheless, the various technical restrictions of RFID technology cannot be ignored, in light of which constant enhancements of transponder systems have to be driven on by communication between science and industry.

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RFID Technology Enables Autonomous Logistic Processes

Michael Freitag, Ernesto Morales and Bernd Scholz-Reiter

RFID technology, wireless communication networks and other novel information and communication technologies will enable intelligent logistic objects in the near future. This will lead to a shift of logistic planning and control processes from the central IT system down to the level of physical material flow. These developments towards an autonomous control of logistic processes require new concepts and methods which will be researched, developed and applied by a recently established Collaborative Research Centre entitled "Autonomous Cooperating Logistic Processes: A Paradigm Shift and its Limitations" (CRC 637) at the University of Bremen, Germany.

Introduction
The right product at the right time at the right place - these are the well-known requirements for logistics. Against the background of highly dynamic markets and the advancing complexity of logistic networks, these goals are increasingly difficult to reach by conventional planning and control methods. In the future, aspects such as flexibility, adaptability and proactivity will be at the centre of attention and can only be achieved by decentralisation and autonomy of the logistic decision-making processes. This will lead to a decentralised coordination of autonomous logistic objects, such as cargo, transit equipment and transportation systems. The autonomy of the logistic objects will be realised by RFID technology.

Today, this technology can provide information about identity, state, location, and possibly further information directly at the object. But in the future, RFID technology will provide active information processing and enable Ubiquitous Computing for autonomous logistic objects. Thereby, transit equipment, transportation systems etc. can be allocated and controlled by the cargo itself. This will lead to substantial changes and improvements in planning and control of logistic processes and its IT systems. Due to the permanent availability and processing of all object information, continuous and transparent information logistics will be possible, allowing the complexity of IT systems for planning and optimisation tasks to be reduced drastically and providing a distributed and almost real-time control of the logistic processes.

To make this possible, the autonomy in logistics requires advanced or new concepts and methods for planning and control. That is, certain planning tasks will continue to be performed by a central instance. But the bigger part of planning tasks will be shifted from the central IT system down to the autonomous logistic objects on the level of the physical flow of goods. The vision is a ubiquitous, global information infrastructure, sometimes referred to as the "internet of things". To manage and control these intelligent "things" in a logistic system, a recently established Collaborative Research Centre entitled "Autonomous Cooperating Logistic Processes: A Paradigm Shift and its Limitations" (CRC 637) at the University of Bremen, Germany, investigate "autonomy" as a new control paradigm for logistic processes.

Collaborative Research Centre "Autonomous Cooperating Logistic Processes"

The basic objective of the CRC 637 is the systematic and broad research in "autonomy" as a new control paradigm for real-life logistic processes. There are three major goals:

- Scientific research of the "autonomy" concept and the development of a theoretical framework for the modelling of autonomous logistic processes,
- Methods and tools for efficient dynamic control systems as well as their communication and coordination geared towards logistics systems,
- Investigation of the impacts of the autonomy paradigm on logistics systems and their future development using modified control methods and processes.

The autonomy paradigm and its application to logistic processes are being developed in a holistic and cross-disciplinary approach. Based on a system concept known from systems engineering, there are three task layers covered in the CRC 637:

- Material flow and logistics,
- Information and communication technologies and knowledge-based methods,
- Organisation and management.

The research focus is, therefore, the autonomous physical flow of wares and goods and its realisation by information systems, as well as the management of autonomous logistic processes.

From the major objectives of the CRC 637, three project domains were derived:

A - Foundations for the modelling of autonomous logistic processes
B - Methods and tools for autonomous logistic processes
C - Applications of autonomous logistic processes

Each project domain contains its own subprojects, which cover the different task layers of the CRC 637 (figure 1).

Application Platform and Demonstrator

The prototypical application of the developed autonomy concepts will be realised on a common application platform. From the contents' point of view, this platform targets on the one hand the clear and vivid demonstration of autonomous logistics concepts, and on the other hand it validates newly developed autonomous control methods in a straightforward environment.
The logistic scenarios will be implemented on the shop floor of the Bremen Institute of Industrial Technology and Applied Work Science (BIBA).

Collaborative Research Centre 637 Autonomous Cooperating Logistic Processes: A Paradigm Shift and its Limitations		
A: Modelling Foundations for Autonomous Logistic Processes	**B: Methods and Tools for Autonomous Logistic Processes**	**C: Applications for Autonomous Logistic Processes**
A1 Fundamental Studies *(Manuf.Engin.)* A2 Sustainable Management *(Econ.)* A3 Monitoring of Autonomous Systems *(Econ.)* A4 Rule-based Graph Transformation *(C.Sc.)* A5 Dynamics of Autonomous Systems *(Manuf.Engin. / Math.)*	B1 Reactive Planning and Control *(Manuf.Engin. / Elec.Engin.)* B2 Adaptive Business Processes - Modelling and Methodology *(Manuf.Engin.)* B3 Mobile Communication Networks and Models *(Elec.Engin.)* B4 Knowledge Management *(C.Sc.)* B5 Risk Management *(C.Sc. / Manuf.Engin.)* B6 Sensor Systems *(Elec.Engin.)* B7 Autonomous Adaptation of Vehicle Schedules *(Econ.)*	Planned for the 2nd and 3rd phase of the CRC
Central Application Platform and Demonstrator		

Figure 1: Structure of the CRC 637.

Topics of cross-project importance are dealt with in working groups to bring in the needed competencies and to capitalise on synergy effects. The following working groups are established:

- Scenarios
- Autonomy
- Modelling
- Methods
- Software Platform
- Applications

During the first phase of the demonstrator, a transportation scenario is implemented, in which people, equipped with PDAs, represent intelligent pieces of goods and trucks. A transportation network is marked on the floor of the BIBA shop, where nodes and edges represent cities and highways on which the participants move along. In this scenario, the in-

Figure 2: Bremen Institute of Industrial Technology and Applied Work Science (BIBA).

Figure 3: Demonstrator of the CRC 637

telligent pieces of goods send transfer orders. The trucks receive these orders and then have to decide whether they accept or reject an order. The aim of every truck is to reach full capacity and avoid deadheads as much as possible.

While running the scenario it becomes clear very soon that processing the entire information in real-time plus the autonomous scheduling of the incoming orders, stresses the truck playing person when playing with a higher number of actors. At this point, strategies are required that are suitable and robust for these complex situations while taking the global objectives into account.

Presently, the demonstrator consists of a WLAN infrastructure (IEEE 802.11b) that allows the communication as well as tracking and tracing of the WLAN objects (in most cases PDAs). As terminal for the participants, PDAs are used that are equipped with a JAVA client for communication purposes. Later on, this platform will be expanded with other technologies like RFID for identification purposes as well as GPS for outdoor scenarios.

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New Technologies - Germany´s Strategy With Regard to the Lisbon Goal

Interview with Min.Dir. Dr. Peter Krause, Head of Department 5 "Information and Communication; New Technologies" in the German Federal Ministry of Education and Research (BMBF)

Question: Dr. Krause, there is currently a lively debate and lots of publications on innovation and Germany's position in this field. Now, what do you think is Germany's position as a research location?
Answer: Compared with other countries, Germany is still one of the world's leading nations in the field of research. All major international companies have research and development laboratories here. Dresden has become Germany's silicon valley. Only recently, General Electric, faced with the decision where to locate its first research and development centre in Europe, opted for Germany. Germany boasts a wide research landscape with internationally renowned research and development institutions, ranging from basic to applied research. The Fraunhofer Gesellschaft for example is seen by many countries as a model for co-operation in economic and scientific research. The merger of GMD with the Fraunhofer Gesellschaft led to Europe's biggest research association for information and communication technology with over 2,500 creative workers. The Max-Planck-Gesellschaft enjoys a very good reputation in the world. Another advantage Germany has are our institutions of higher education. The number of first-year students has markedly risen since 1998. There is again an increased demand for enrolment particularly in the natural and engineering sciences, which are basic to future innovators. But mind you: adjusted for inflation, the United States today spends 38 percent more on R&D than it did in 1991. In Germany R&D expenditure increased by only 14.5 percent over the same period. The German government has therefore launched a partnership for innovation campaign jointly with the research and economic community: a partnership for research and development. This innovation drive is part of the German government's so-called agenda 2010 reforms. These are intended to ensure the

Min.Dir. Dr. Peter Krause

government's capacity to act, giving it the freedom to focus on future-oriented investments as a priority - investments in education and research. The aim is to make Germany one of the world lead-ers in the high-tech fields in the long run, thereby ensuring growth and pros-