



**Test Execution and Test Management  
for Numerical Control Software**

Best Practice Action IST-1999-20333

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# Technology Implementation Plan

Final version before final term (contractual obligation)

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<b>Type:</b>	Plan
<b>Activity:</b>	WP 1; Technology Implementation Plan
<b>Date:</b>	04.03.02
<b>Status:</b>	Released
<b>Name of document:</b>	TIP_TEAM20333_V1.doc
<b>Availability:</b>	Commission PO; Cluster Members

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**Part 1      Overview and Description of the Project and its Results**

**EC PROGRAMME :**  
**PROJECT TITLE & ACRONYM:**  
**CONTRACT NUMBER :**  
**PROJECT WEB SITE (if any) :**  
**PARTNERS NAMES :**

<b>1.1.2-4.3.1</b>
<b>Test Execution and Test Management for Numerical Control Software – TEAM</b>
<b>IST-1999-20333</b>
<b>www.isg-stuttgart.de/team</b>
<b>Industrielle Steuerungstechnik GmbH - ISG          FISW Steuerungstechnik GmbH</b>

**1.1. Executive summary**

**a) Research objectives and results:**

*The main technical objectives of the TEAM project was the improvement of the Numerical Control (NC) software test execution and the improvement of NC test management. This resulted in a process improvement by test process improvement. Due to this improvement the number of errors in released software components was reduced and a large number of errors were detected in early development phases. The increase of the test effectiveness increased the test run frequency while the overall test effort was decreased. So higher quality with less effort could be achieved.*

*The improvement of the test process improved the quality of ISG's NC components. It is expected that this will lead to a higher acceptance of ISG's NC on the market in future. It will also open up new markets for NC applications. As the test effort became a more calculable part within the software development process due to the improvement of the test management, ISG expects also an improvement for the project management in future.*

*The introduction of an automatic test environment (regression test) within the scope of analytical QA activities has lead to the aimed improvement of NC test execution. This new test tool makes it possible to execute a large number of test cases in a reduced time effort to detect and localise weaknesses and defects within the complete software components. This offers the possibility to increase the number of the test run frequency. During the test run special protocol files can be created. This protocol files can be checked by experienced software developers. So bugs, e.g. based on new developments, side effects, cross dependencies and also other bug fixes can be detected in an automatic way. However, the evaluation of the protocol files is still a very time consuming method which currently increase the overall test effort. So this automatic test environment and especially the evaluation method must be improved. But the positive effect of more detected bugs before a customer delivery is already become apparent.*

*In addition to the possibility to find functional errors within the software, further kinds of defects (e.g. memory corruption, memory leaks, memory allocation errors, variable initialisation errors, variable definition conflicts, pointer errors) need to be detected during the test process. So a further project objective was to find a suitable commercial test tool. ISG made a decision for the use of INSURE++ from PARASOFT. This tool met the most requirements which are interesting and important for ISG. Using the opportunity to evaluate the code coverage while running the NC, the effectiveness of the above mentioned automatic functional test can be examined.*

**b) Expected deliverables :**

- *Deliverable about Tailoring of QA activities*
- *Deliverable about Measurement Activities*
- *Deliverable about set up of analytical QA activities*
- *Deliverable about set up of analytical QA activities*
- *Deliverable about set up of constructive QA activities*
- *Deliverable about set up of constructive QA activities*
- *Deliverable about measurement activities*
- *Deliverable about training activities*
- *Deliverable about dissemination activities*

**c) Broad dissemination and use intentions for the expected outputs :**

*Dissemination of the TEAM project's outcomes were executed on different levels. Beside the ISG internal and the cluster internal dissemination activities, additional activities were executed on international level. On international conferences the ideas of the TEAM project were presented to a broad target audience.*

*Additionally a www presentation was set up ([www.isg-suttgart.de/team](http://www.isg-suttgart.de/team)) in order disseminate the project's results in a lasting way. The www presentation will also be maintained after the conclusion of the TEAM project.*

*The analytical QA activities (regression test, commercial software test tool INSURE++) will be introduced to ISG's software development process according to test plans, developed within the TEAM project. Depending on the overall acceptations of the project results among ISG's software developers the analytical QA activities will be defined as standard for the software development process. As ISG has a special business relation to some customers, who buy the NC software as source code and do some additional development with this software on their own, the TEAM project's results may also be introduced to these customer's software development process.*

## 1.2. Overview of all main project results

No.	Self-descriptive title of the result	Category *	Partner(s) owning the result(s) (referring in particular to specific patents, copyrights, etc.) & involved in their further use
1	<i>Set-up and introduction of a regression test environment for NC software</i>	B	Industrielle Steuerungstechnik GmbH - ISG
2	<i>Introduction of a commercial software test tool (INSURE++) for NC software</i>	B	Industrielle Steuerungstechnik GmbH – ISG
3	<i>Introduction of test plans for an improved NC software test management</i>	B	Industrielle Steuerungstechnik GmbH - ISG

\* A: results usable outside the consortium / B: results usable within the consortium / C: non usable results

## 1.3. Quantified Data on the dissemination and use of the project results

Items about the dissemination and use of the project results (consolidated numbers)	Currently achieved quantity	Estimated future* quantity
# of product innovations (commercial)	0	0
# of process innovations (commercial)	1	0
# of new services (commercial)	0	0
# of new services (public)	0	0
# of new methods (academic)	0	0
# of scientific breakthrough	0	0
# of technical standards to which this project has contributed	0	0
# of EU regulations/directives to which this project has contributed	0	0
# of international regulations to which this project has contributed	0	0
# of PhDs generated by the project	0	0
# of grantees/trainees including transnational exchange of personnel	0	0

# = number of ... / \* "Future" means expectations within the next 3 years following the end of the project

**1.4. Description of each single result**

<b>1</b>	<b><i>Set-up and introduction of a regression test environment for NC software</i></b>
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**SUMMARY**

*The introduction of an automatic test environment (regression test) within the scope of analytical QA activities has lead to an improvement of NC test execution. This new test tool makes it possible to execute a large number of test cases in a reduced time effort to detect and localise weaknesses and defects within the complete software components. This offers the possibility to increase the test run frequency. During the test run special protocol files can be created. This protocol files can be checked by experienced software developers. So bugs, e.g. based on new developments, side effects, cross dependencies and also other bug fixes can be detected in an automatic way. However, the evaluation of the protocol files is still a very time consuming method which currently increase the overall test effort. So especially the evaluation method must be improved in that way, that also this process must be executed automatically or requires at least less manual effort. But the positive effect to detect more bugs before a customer delivery is became already apparent. Nevertheless the regression test process represents an important method of total quality inspection activities. It will be used for the verification of the existing basic functionality of the NC system after a change within the system and helps to detect and eliminate bugs and malfunctions before a customer delivery.*

*The developed test method is transferable to all software products, which are too complex to evaluate test results manually respectively according to specifications (formal validation). Defining a certain version of a complex software product (NC in this case) to be the reference for an automated reference test, is advisable, if the main part of the new version (test version) is reused from the reference version.*

*Although a deeper investigation of any cost reductions during the software development process are not done, it exists the expectation, that the software development costs can be reduced with this test procedure. This expectation is valid as it is already proven, that the detection of software errors in early development phases reduces costs. An early software error detection can be achieved with this test procedure.*

***Please categorise the result using codes from Annex 1***

<u>Subject descriptor codes:</u>	<b>54</b>	<b>137</b>	<b>579</b>	<b>611</b>
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<b>2</b>	<b><i>Introduction of a commercial software test tool (INSURE++) for NC software</i></b>
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**SUMMARY**

*The results have shown, that INSURE++ met the expectations on a commercial tool. The tool can handle large applications like the NC software in a reliable way and is easy to install and to use.*

*The tool supports the compiling and development process in a very good way and also the dynamic code analysing (memory leaks and code coverage) is supported very well. So the detection of a lot of errors can be shifted in an earlier stage of development process.*

*In the same way ISG uses this commercial test tool all software developing companies, dealing with large and complex software products can use this tool. The applicability of this tool could be proven within the TEAM project.*

***Categorisation of the result using codes from Annex 1***

<u>Subject descriptor codes:</u>	<b>54</b>	<b>137</b>	<b>579</b>	<b>611</b>
----------------------------------	-----------	------------	------------	------------

<b>3</b>	<b><i>Introduction of test plans for an improved NC software test management</i></b>
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**SUMMARY**

*ISG introduced a commercial tool to improve the software development process and developed a regression test to detect the effects of the software changes on the whole NC-kernel software. Within the scope of constructive QA activities ISG defined, that for a all change processes the new QA methods must be used in addition to the already existing. The commercial tool can be used during coding, integration and testing. The regression test checks the functional completeness of the NC-kernel software after conclusion of the change processes.*

*Please categorise the result using codes from Annex 1*

<u>Subject descriptor codes:</u>	<b>54</b>	<b>137</b>	<b>579</b>	<b>611</b>
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**CURRENT STAGE OF DEVELOPMENT**

*Please tick one category only ✓*

Scientific and/or Technical knowledge (Basic research)	<input type="checkbox"/>
Guidelines, methodologies	<input checked="" type="checkbox"/>
Software code	<input type="checkbox"/>
Experimental development stage (laboratory prototype)	<input type="checkbox"/>
Prototype/demonstrator available for testing	<input type="checkbox"/>
Results of demonstration trials available	<input type="checkbox"/>
Other (please specify.):	<input type="checkbox"/>

**DOCUMENTATION AND INFORMATION ON THE RESULT**

*List main information and documentation, stating whether public or confidential.*

<i>Documentation type</i>	<b>Details (Title, ref. number, general description, language)</b>	<b>Status: PU=Public CO=Confidential</b>
<i>Article</i>	“ <i>Test Execution and Test Management for Numerical Control Software</i> ”; <i>EuroSPI’2001 Conference, Limerick, Ireland, 10.10.-12.10.2001.</i>	<i>PU</i>
<i>Article</i>	“ <i>Sichere Robotersteuerung für den Einsatz in der Chirurgie</i> ” <i>GMA-Kongress 2001, Automatisierungstechnik im Spannungsfeld neuer Technologien, Baden-Baden, Germany, 19th - 25th August 2001</i>	<i>PU</i>
<i>Article</i>	“ <i>Design and Test of a Safe Numerical Control for Robotic Surgery</i> ” <i>51st CIRP General Assembly, Nancy, France 19th - 25th August 2001</i>	<i>PU</i>

**INTELLECTUAL PROPERTY RIGHTS**

*Indicate all generated knowledge and possible pre-existing know-how (background or sideground) being exploited*

<b>Type of IPR</b>	<b>Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.</b>		<b>Knowledge (K)/ Pre-existing know-how (P)</b>
	<b>Current</b>	<b>Foreseen</b>	
Patent applied for	<input type="checkbox"/> .....	<input type="checkbox"/>	
Patent search carried out	<input type="checkbox"/> .....	<input type="checkbox"/>	
Patent granted	<input type="checkbox"/> .....	<input type="checkbox"/>	
Registered design	<input type="checkbox"/> .....	<input type="checkbox"/>	
Trademark applications	<input type="checkbox"/> .....	<input type="checkbox"/>	
Copyrights	<input type="checkbox"/> .....	<input type="checkbox"/>	
Secret know-how	<input type="checkbox"/> .....	<input type="checkbox"/>	
other – please specify :	<input checked="" type="checkbox"/> ... <i>Test procedure</i> .....	<input type="checkbox"/>	<b>P and K</b>

**MARKET APPLICATION SECTORS**

*Please describe the possible sectors for application using the NACE classification in Annex 2.*

<b>Market application sectors</b>	<b>731</b>			
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**1.5. Quantified data about the result**

<b>1</b>	<b><i>Set-up and introduction of a regression test environment for NC software</i></b>		
<b>Items (about the results)</b>	<b>Actual current quantity <sup>a</sup></b>	<b>Estimated (or future) quantity <sup>b</sup></b>	
Time to application / market (in months from the end of the research project)	<i>0</i>	-	
Number of (public or private) entities potentially involved in the implementation of the result :	<i>1</i>	-	
of which : number of SMEs :	<i>1</i>	-	
of which : number of entities in third countries (outside EU) :	<i>0</i>	-	
Targeted user audience: # of reachable people	<i>4500</i>	<i>10.000</i>	
# of S&T publications (referenced publications only)	<i>3</i>	-	
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	<i>1</i>	<i>1</i>	
# of publications addressing decision takers / public authorities / etc.	<i>1</i>	-	
Visibility for the general public	<i>Yes</i>		

<b>2</b>	<b><i>Introduction of a commercial software test tool (INSURE++) for NC software</i></b>		
<b>Items (about the results)</b>	<b>Actual current quantity <sup>a</sup></b>	<b>Estimated (or future) quantity <sup>b</sup></b>	
Time to application / market (in months from the end of the research project)	<i>0</i>	-	
Number of (public or private) entities potentially involved in the implementation of the result :	<i>1</i>	-	
of which : number of SMEs :	<i>1</i>	-	
of which : number of entities in third countries (outside EU) :	<i>0</i>	-	
Targeted user audience: # of reachable people	<i>4500</i>	<i>10.000</i>	
# of S&T publications (referenced publications only)	<i>3</i>	-	
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	<i>1</i>	<i>1</i>	
# of publications addressing decision takers / public authorities / etc.	<i>1</i>	-	
Visibility for the general public	<i>Yes</i>		

<b>3</b>	<b><i>Introduction of test plans for an improved NC software test management</i></b>	
<b>Items (about the results)</b>	<b>Actual current quantity <sup>a</sup></b>	<b>Estimated (or future) quantity <sup>b</sup></b>
Time to application / market (in months from the end of the research project)	<b>0</b>	<b>-</b>
Number of (public or private) entities potentially involved in the implementation of the result :	<b>1</b>	<b>-</b>
of which : number of SMEs :	<b>1</b>	<b>-</b>
of which : number of entities in third countries (outside EU) :	<b>0</b>	<b>-</b>
Targeted user audience: # of reachable people	<b>4500</b>	<b>10.000</b>
# of S&T publications (referenced publications only)	<b>3</b>	<b>-</b>
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	<b>1</b>	<b>1</b>
# of publications addressing decision takers / public authorities / etc.	<b>1</b>	<b>-</b>
Visibility for the general public	<b>Yes</b>	

<sup>a</sup> Actual current quantity = the number of items already achieved to date.

<sup>b</sup> Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.

I, **project co-ordinator**, confirm the publishable information contained in this part 1 (sections 1.1 to 1.5) of the Technological Implementation Plan.

**Signature:**

**Name:**

***Dr. Dieter Scheifele***

**Date:**

**Organisation:**

***Industrielle Steuerungstechnik GmbH - ISG***

**Part 2      Description of the intentions**

**2.1 : Description of the use and the dissemination of results****MANDATORY INFORMATION :****CONTRACT NUMBER :**

IST-1999-20333

**PARTNER's NAME :**Industrielle Steuerungstechnik GmbH – ISG  
FISW Steuerungstechnik GmbH**PARTNER's WEB SITE (if any) :**

www.isg-stuttgart.de/team

**CONTACT PERSON(S):**

<b>Name</b>	Dr.-Ing. Dieter Scheifele
<b>Position/Title</b>	CEO
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<b>E-mail</b>	dieter.scheifele@isg-stuttgart.de

**No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULTS**

1	<p><i>Set-up and introduction of a regression test environment for NC software</i></p> <p><i>The introduction of an automatic test environment (regression test) within the scope of analytical QA activities has lead to an improvement of NC test execution. This new test tool makes it possible to execute a large number of test cases in a reduced time effort to detect and localise weaknesses and defects within the complete software components.</i></p>
2	<p><i>Introduction of a commercial software test tool (INSURE++) for NC software</i></p> <p><i>The results have shown, that INSURE++ met the expectations on a commercial tool. The tool can handle large applications like the NC software in a reliable way and is easy to install and to use.</i></p>
3	<p><i>Introduction of test plans for an improved NC software test management</i></p> <p><i>Within the scope of constructive QA activities ISG defined, that for all change processes the new QA methods(regression test, commercial test tool) must be used in addition to the already existing.</i></p>

**FOR EACH MAIN RESULT, TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT.**

<b>1</b>	<b><i>Set-up and introduction of a regression test environment for NC software</i></b>	
<i>Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale</i>		
<b>Activity</b>	<b>Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 1.5 and 2.2).</b>	<b>Timescale (months)</b>
<i>Web presentation</i>	<i>The results will be published after the project's conclusion</i>	<i>1</i>

<b>2</b>	<b><i>Introduction of a commercial software test tool (INSURE++) for NC software</i></b>	
<i>Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale</i>		
<b>Activity</b>	<b>Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 1.5 and 2.2).</b>	<b>Timescale (months)</b>
<i>Web presentation</i>	<i>The results will be published after the project's conclusion</i>	<i>1</i>

<b>3</b>	<b><i>Introduction of test plans for an improved NC software test management</i></b>	
<i>Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale</i>		
<b>Activity</b>	<b>Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 1.5 and 2.2).</b>	<b>Timescale (months)</b>
<i>Web presentation</i>	<i>The results will be published after the project's conclusion</i>	<i>1</i>

**FORESEEN COLLABORATIONS WITH OTHER ENTITIES**

*Please tick appropriate boxes (✓) corresponding to your most probable follow-up.*

<b>R&amp;D</b>	Further research or development	<input checked="" type="checkbox"/>	<b>FIN</b>	Financial support	<input type="checkbox"/>
<b>LIC</b>	Licence agreement	<input type="checkbox"/>	<b>VC</b>	Venture capital/spin-off funding	<input type="checkbox"/>
<b>MAN</b>	Manufacturing agreement	<input type="checkbox"/>	<b>PPP</b>	Private-public partnership	<input type="checkbox"/>
<b>MKT</b>	Marketing agreement/Franchising	<input type="checkbox"/>	<b>INFO</b>	Information exchange, training courses	<input type="checkbox"/>
<b>JV</b>	Joint venture	<input type="checkbox"/>	<b>CONS</b>	Available for consultancy	<input type="checkbox"/>
			<b>Other</b>	(please specify) _____	<input type="checkbox"/>

**2.2 : Quantified data for main result**

<b>Items</b>	<b>Currently achieved quantity <sup>a</sup></b>	<b>Estimated future quantity <sup>b</sup></b>
Economic impacts (in EURO)	.....0.....	.....0.....
# of licenses issued (within EU)	.....0.....	.....0.....
# of licenses issued (outside EU)	.....0.....	.....0.....
Total value of licenses (in EURO)	.....0.....	.....0.....
# of entrepreneurial actions (start-up company, joint ventures...)	.....0.....	.....0.....
# of direct jobs created <sup>c</sup>	.....0.....	.....0.....
# of direct jobs safeguarded <sup>c</sup>	.....1.....	.....1.....
# of direct jobs lost	.....0.....	.....0.....

<sup>a</sup> The added value or the number of items already achieved to date.

<sup>b</sup> Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).

<sup>c</sup> "Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation  
# = number of ...

I confirm the information contained in part 2 of this Technological Implementation Plan and I certify that these are our exploitation intentions

**Signature:**

**Name: Dr. Dieter Scheifele**

**Date:**

**Part 3      Search for Collaboration through Commission services**

**CONTACT PERSON FOR THIS EXPLOITABLE RESULT**

Name	Dr.-Ing. Dieter Scheifele
Position	CEO
Organisation	Industrielle Steuerungstechnik GmbH – ISG
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Telephone	+49 / (0)711 / 22992-30
Fax	+49 / (0)711 / 22992-25
E-mail	dieter.scheifele@isg-stuttgart.de

**COLLABORATIONS SOUGHT**

*Please tick appropriate boxes (✓) corresponding to your needs.*

<b>R&amp;D</b>	Further research or development	<input checked="" type="checkbox"/>	<b>FIN</b>	Financial support	<input type="checkbox"/>
<b>LIC</b>	Licence agreement	<input checked="" type="checkbox"/>	<b>VC</b>	Venture capital/spin-off funding	<input checked="" type="checkbox"/>
<b>MAN</b>	Manufacturing agreement	<input type="checkbox"/>	<b>PPP</b>	Private-public partnership	<input type="checkbox"/>
<b>MKT</b>	Marketing agreement/Franchising	<input checked="" type="checkbox"/>	<b>INFO</b>	Information exchange	<input checked="" type="checkbox"/>
<b>JV</b>	Joint venture	<input type="checkbox"/>	<b>CONS</b>	Available for consultancy	<input type="checkbox"/>
				<b>Other</b>	(please specify) _____ <input type="checkbox"/>

**POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE**

*Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.*

R&D: ISG is ready to participate in any kind of R&D project. Especially, in the field of numerical control applications, ISG can supply sophisticated, open, modular CNC software as a base of R&D activities.

MKT: ISG is ready and willing to give potential marketing partners the opportunity to sell ISG’s products under either their on name or in the name of ISG.

LIC: ISG is ready and willing to commit License agreements regarding the ISG’s products.

INFO: ISG is open for every kind of information exchange and can offer an exhaustive extend of Information around CNC techniques. ISG comes up with an experience of over 200 engineer man years in this field.

**PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE**

*Please, clearly describe the profile and the expected input from the external partner(s).*

VC: ISG is interested in a co-operation with a venture capital supplier which is ready to invest in a huge project regarding PC-based CNC-control system.

I confirm the information contained in part 3 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

**Signature:** **Name:** **Dr. Dieter Scheifele**

**Date:** **ISG** **Organisation:** **Industrielle Steuerungstechnik GmbH -**

**Part 4      Comment on European Interest**

## **4.1. Community added value and contribution to EU policies**

### **4.1.1 European dimension of the problem**

*The profile of the wider community which will benefit from the results of the TEAM-project will be first of all software practitioners and software houses developing software in a comparable way as ISG does. That means the development of complex systems that consists out of interchangeable software components.*

*Automation system manufacturers can profit out of the TEAM-project's results concerning QA activities in general and if they develop software in a component based way from QA activities for NC components in particular.*

### **4.1.2 Contribution to developing S&T co-operation at international level. European added value.**

*On basis of the knowledge gained out of the TEAM project co-operations with partners can be organised on European level. For this purpose the possibility to apply for common research projects on European level with the support of the EC will be investigated.*

*For the bilateral co-operations with European partners further contacts will be expanded. Positive results will also be used for the set-up of consortiums for common research projects on European level with the support of the EC.*

### **4.1.3 Contribution to policy design or implementation**

*A functioning interoperability of a numerical control (NC) as a component within a complex automation systems (consisting out of NC, PLC, HMI, Drives, etc.) as it is defined e.g. within the European project OSACA is a basic prerequisite for ISG. In this way an interoperability of the NC with other automation components can be achieved on European as well as on global level in future.*

*Through the extension of functionality of the existing NC components of ISG as well as through the quality improvement of this components ISG is enabled to provide its NC components for medical devices (e.g. surgical robots, robotal devices for handicapped person). Through the automation of such medical devices with NC components existing surgery methods can be optimised and new surgery methods can be established.*

*Through the provision of NC components for training machines used at vocational schools the education of mechanics can be executed in a practically oriented way. So the mechanics can be trained at an early stage of their education with NCs, they will be confronted later on in their daily work.*

## **4.2. Contribution to Community social objectives**

### **4.2.1 Improving the quality of life in the Community**

*The quality of life of handicapped people can be improved through the automation of adequate robotal devices. For the support of activities (e.g. within the household) a robotal device needs complex control systems. ISG's NC components can be used for such applications. For this purpose the NC components require a high reliability that can be reached with appropriate test methods and a functioning test management. Both, an improved test execution as well as an improved test management, are introduced within the TEAM-project.*

*The receipt of a certification by a notified body for the permission to equip a medical device (e.g. a surgical robot) with NC components depends among other things on the QA activities executed. For a health promotion through the use of ISG's NC components for medical devices the QA activities at ISG had to be improved.*

*The improvement of QA activities within the software development process at ISG lead to a reduction of errors within released software components. This reduction implicitly increased the reliability of the NC components,*

*used for the control of machine tools, robots, wood-working machines or medical devices. Although an absolute safety can never be achieved the safety of this production systems (machine together with a control) will increase in the same way the reliability of the NC components increases. Positive results of the TEAM-project lead therefore to less risky working places at such production systems.*

#### **4.2.2 Provision of appropriate incentives for monitoring and creating jobs in the Community**

*Through the improvement of the QA activities' effectiveness ISG is able to supply training machines with its NC components. So it is possible to train mechanics during the practical part of their education at vocational schools with NCs suitable for industrial use. In this way the education level of mechanics can be improved.*

*Through the execution of the TEAM-project ISG could consolidate its position on the NC market, as the quality demands on NC software components are continuously growing. So the employment prospects at ISG can be ensured.*

#### **4.2.3 Supporting sustainable development, preserving and/or enhancing the environment**

*Through the execution of the TEAM-project ISG could consolidate its position on the NC market. This is the main strategic impact the improvement of the test execution and test management involved during the execution of the TEAM-project. That means due to the quality improvement of its NC components without an increase of the overall test effort ISG can maintain and extend the number of customers.*

**ANNEX 1: SUBJECT DESCRIPTOR CODES**

1	ACARIANS	71	BIOMASS PROCESS INTEGRATION AND ENVIRONMENTAL IMPACTS
2	ACCIDENTOLOGY	72	BIOMECHANICS, BIOMEDICAL ENGINEERING
3	ACCOUNTING	73	BIOMEDICAL ETHICS
4	ACOUSTICS	74	BIOMEDICAL SCIENCES
5	ADMINISTRATIVE SCIENCES, ADMINISTRATION	75	BIOMOLECULES, BIOPLASTICS, BIOPOLYMERS
6	ADULT EDUCATION, PERMANENT EDUCATION	76	BIOPHYSICS, MEDICAL PHYSICS
7	AERONAUTICS	77	BIOREACTORS
8	AGEING	78	BIOREMEDIATION
9	AGRICULTURAL CHEMISTRY	79	BIOSAFETY
10	AGRICULTURAL ECONOMICS	80	BIOSENSORS
11	AGRICULTURAL ENGINEERING/TECHNOLOGY	81	BIOTECHNOLOGY, BIOENGINEERING
12	AGRICULTURAL MARKETING/TRADE	82	BIOTRANSFORMATION
13	AGRICULTURAL PRODUCTION SYSTEMS	83	BOREAL FOREST
14	AGRICULTURAL SCIENCES, AGRICULTURE	84	BRAIN DEVELOPMENT
15	AGRI-FOOD, AGRI-ENVIRONMENT	85	BRAIN THEORY, BRAIN MAPPING
16	AGRONOMY	86	BROADBAND TECHNOLOGIES
17	AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION	87	BROADCASTING
18	AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT	88	BROKERAGE SERVICES
19	AIR TRANSPORT TECHNOLOGY	89	BUILDING CONSTRUCTION, SHELL SUSTAINABILITY
20	AIRCRAFT	90	BUSINESS COMMUNICATION
21	AIRPORT OPERATIONS/PROCEDURES	91	BUSINESS ECONOMICS/STUDIES, ORGANISATION AND PROCESSES
22	ALGAE	92	CARBOCHEMISTRY, PETROCHEMISTRY, FUELS AND EXPLOSIVES TECHNOLOGY
23	ALGEBRA	93	CARBOHYDRATES AND OTHER MACROMOLECULES METABOLISM
24	ALGEBRAIC TOPOLOGY	94	CARBON DIOXIDE CAPTURE/STORAGE/DISPOSAL
25	ALGORITHMS AND COMPLEXITY	95	CARDIOVASCULAR SYSTEM
26	ALLERGOLOGY	96	CARE AND HEALTH SERVICES, HELP TO THE HANDICAPPED
27	ALTERNATIVE PROPULSION SYSTEMS	97	CELL COMMUNICATION
28	ANALYTICAL CHEMISTRY	98	CENTRAL AND EASTERN EUROPEAN COUNTRIES
29	ANIMAL BANKS AND REPOSITORIES	99	CERAMIC MATERIALS AND POWDERS
30	ANIMAL BIOTECHNOLOGY	100	CERTIFICATION
31	ANIMAL BREEDING/REPRODUCTION/NUTRITION	101	CHEMICAL METROLOGY
32	ANIMAL FEED, ANIMAL PRODUCTION	102	CHEMICAL TECHNOLOGY AND ENGINEERING
33	ANIMAL HEALTH, ANIMAL WELFARE	103	CHEMISTRY/HOMOGENEOUS AND HETEROGENEOUS CATALYSIS/THEORETICAL/NANOCHEMISTRY
34	ANIMAL PARASITIC DISEASES	104	CHRONOLOGY, DATATION TECHNOLOGY
35	ANIMAL PHYSIOLOGY	105	CIVIL ENGINEERING (INCL PAVEMENTS AND STRUCTURES)
36	ANIMAL PRODUCTS	106	CLINICAL GENETICS, BIOLOGY
37	ANTHROPOGENIC IMPACT ON ECOSYSTEMS	107	CLINICAL PHYSICS, RADIOLOGY, TOMOGRAPHY, MEDICAL INSTRUMENTATION, MEDICAL IMAGING
38	ANTHROPOLOGY	108	CLINICAL RESEARCH, CLINICAL TRIALS, COMPUTERISED CLINICAL SYSTEMS
39	ANTIBIOTICS	109	COAL MINING TECHNOLOGIES
40	ANTICANCER THERAPIES	110	COASTAL MORPHOLOGICAL CHANGES AND COASTAL DEFENSE MECHANISMS
41	ANTI-FRAUD	111	COASTAL ZONE ECOSYSTEMS AND MANAGEMENT
42	APPLIED MATHEMATICS	112	COATS AND SURFACE TREATMENT
43	APPLIED PHYSICS	113	COGNITIVE SCIENCE
44	AQUACULTURE, AQUACULTURE TECHNOLOGY	114	COLLOIDS
45	ARCHIVISTICS/DOCUMENTATION/TECHNICAL DOCUMENTATION	115	COMBINATORIAL CHEMISTRY
46	ARCTIC ENVIRONMENT	116	COMBINED HEAT AND POWER SYSTEMS
47	ARTIFICIAL INTELLIGENCE	117	COMBUSTION BASICS AND EFFICIENCY
48	ARTS	118	COMMERCIAL AND INDUSTRIAL ECONOMICS
49	ASSESSMENT AND MANAGEMENT OF LIVING RESOURCES	119	COMMON AGRICULTURAL POLICY
50	ASTRONOMY	120	COMMUNICATION ENGINEERING/TECHNOLOGY
51	ASTROPHYSICS/PLANETARY GEOLOGY	121	COMMUNICATION SCIENCES/HUMAN COMPUTER INTERACTIONS
52	ATOMIC AND MOLECULAR PHYSICS	122	COMMUNITY DEVELOPMENT, COMMUNITY STUDIES
53	AUDIOVISUAL COMMUNICATION	123	COMPANY RE-ENGINEERING/ORGANISATIONAL DEVELOPMENT
54	AUTOMATION, ROBOTIC CONTROL SYSTEMS	124	COMPOSITE MATERIALS
55	BACTERIOLOGY	125	COMPUTATIONAL BIOLOGY
56	BANKING	126	COMPUTATIONAL CHEMISTRY AND MODELING
57	BENCHMARKING TECHNIQUES	127	COMPUTATIONAL MATHEMATICS/DISCRETE MATHEMATICS
58	BIOASSAYS	128	COMPUTATIONAL PHYSICS
59	BIOCATALYSTS	129	COMPUTER SCIENCE/ENGINEERING, NUMERICAL ANALYSIS, SYSTEMS, CONTROL
60	BIOCHEMICAL TECHNOLOGY	130	COMPUTER TECHNOLOGY/GRAPHICS, META COMPUTING
61	BIOCHEMISTRY, METABOLISM	131	COMPUTER-BASED TRAINING
62	BIOCOMPUTING, MEDICAL INFORMATICS, BIOMATHEMATICS, BIOMETRICS		
63	BIODEGRADATION		
64	BIODIVERSITY		
65	BIOFERTILIZERS		
66	BIOGAS PRODUCTION		
67	BIOLOGICAL COLLECTIONS: MUSEA AND RELATED INFORMATION RESOURCES		
68	BIOLOGICAL ENGINEERING		
69	BIOLOGICAL MONITORING/RISK FACTORS AND ASSESSMENT		
70	BIOLOGICAL SCIENCES, BIOLOGY		

132	CONDENSED MATTER: ELECTRONIC, MAGNETIC AND SUPERCONDUCTIVE PROPERTIES	195	EMPLOYMENT STUDIES
133	CONDENSED MATTER: MECHANICAL AND THERMAL PROPERTIES	196	ENDOCRINOLOGY, SECRETING SYSTEMS, DIABETOLOGY
134	CONDENSED MATTER: OPTICAL AND DIELECTRIC PROPERTIES	197	ENERGY AND CLIMATE CHANGE
135	CONDENSED MATTER: SOFT MATTER AND POLYMER PHYSICS	198	ENERGY CONVERSION PROCESSES OR CYCLES/CONVERSION FROM COAL
136	CONSUMER SCIENCES, CONSUMERS' RIGHTS	199	ENERGY MANAGEMENT SYSTEM
137	CONTROL ENGINEERING	200	ENERGY MARKET ANALYSIS
138	COOPERATIVE WORKING	201	ENERGY PRODUCTION FROM BIOMASS / WASTE
139	CORROSION	202	ENERGY RESEARCH/RTD POLICY
140	COSMOLOGY	203	ENERGY, RENEWABLE ENERGIES, ELECTRICITY STORAGE
141	CRIMINOLOGY	204	ENGINEERING, CONCURRENT ENGINEERING
142	CROP, CROP INPUTS/MANAGEMENT/YIELD ESTIMATION	205	ENTOMOLOGY, PLANT PARASITOLOGY
143	CULTURAL HERITAGE: PRESERVATION AND RESTORATION/CULTURAL STUDIES	206	ENTREPRENEURSHIP, SPIN OFFS, NEW TECHNOLOGY BASED BUSINESS
144	CULTURE COLLECTIONS: MICROBIAL, CELL, TISSUE, GERMPLOASM	207	ENVIRONMENT, ENVIRONMENTAL SCIENCE
145	CURRICULUM STUDIES	208	ENVIRONMENTAL ECONOMICS/NATURAL RESOURCES ECONOMICS
146	CYBERNETICS	209	ENVIRONMENTAL HEALTH
147	CYTOGENETICS	210	ENVIRONMENTAL IMPACTS/INTERACTIONS
148	CYTOLOGY, CANCEROLOGY, ONCOLOGY	211	ENVIRONMENTAL INDICATORS/MONITORING/RISK ASSESSMENT
149	DATA PROTECTION, STORAGE TECHNOLOGY, CRYPTOGRAPHY	212	ENVIRONMENTAL LAW/TREATIES/POLICY
150	DATABASES, DATABASE MANAGEMENT, DATA MINING	213	ENVIRONMENTAL TECHNOLOGY/ENGINEERING, POLLUTION CONTROL
151	DECENTRALISED GENERATION OF ELECTRICITY/HEAT	214	EPIDEMIOLOGY
152	DECISION SUPPORT TOOLS	215	ERGONOMICS
153	DEEP WATER EXPLOITATION	216	EROSION
154	DEMOGRAPHY	217	EUROPEAN INTEGRATION
155	DESIGN, DESIGN ENGINEERING	218	EUROPEAN LAW
156	DEVELOPMENT OF CLEAN FUELS FOR TRANSPORT	219	EUROPEAN STUDIES
157	DEVELOPMENT POLICIES AND STUDIES	220	EVALUATION
158	DEVELOPMENT TECHNOLOGY, ANIMAL GROWTH, ONTOLOGY, EMBRYOLOGY	221	EXPLOITATION OF RESEARCH RESULTS
159	DIAGNOSTICS, DIAGNOSIS	222	EXTENSIFICATION
160	DIGITAL SYSTEMS, DIGITAL REPRESENTATION	223	EXTERNALITIES
161	DISABILITIES, HANDICAPS AND HANDICAPPED	224	FARMHOUSE CONSTRUCTION
162	DISEASES: RARE/CHRONIC/DEGENERATIVE, ETIOLOGIC FACTORS	225	FARMING SYSTEMS
163	DIVERSIFICATION IN AGRICULTURE/FORESTRY	226	FERMENTATION
164	DNA CHIP	227	FINANCIAL SCIENCE, FINANCE
165	DNA THERAPIES	228	FINE CHEMICALS, DYES AND INKS
166	DOWNSTREAM PROCESSING	229	FISH/FISHERIES
167	"DRILLING TECHNOLOGY; DEEP DRILLING"	230	FISHING METHODOLOGIES/SELECTIVITY
168	DRUG ABUSE, ADDICTION	231	FOOD AND DRINK TECHNOLOGY
169	DRUG DISCOVERY, PROFILING, TARGETING	232	FOOD CHEMISTRY, FOOD INGREDIENTS
170	DRYLAND AND ARID ZONE ECOSYSTEMS	233	FOOD MICROBIOLOGY
171	EARTH OBSERVATION APPLICATIONS AND POLICY	234	FOOD PROCESSING/PACKAGING
172	EARTH OBSERVATION TECHNOLOGY AND INFORMATION EXTRACTION	235	FOOD QUALITY MANAGEMENT/POLICY/LABELLING
173	EARTH SCIENCE, EARTH OBSERVATION/STRATIGRAPHY/SEDIMENTARY PROCESSES	236	FOOD TOXICOLOGY
174	EARTH SCIENCES FOR CLIMATE RESEARCH	237	FOREST ECOSYSTEMS
175	ECOLOGY, ECOSYSTEMS, ECOLOGICAL EVOLUTION/DYNAMICS	238	FOREST GENETICS
176	ECONOMIC AND ENVIRONMENT IMPACTS	239	FOREST PHYSIOLOGY AND PATHOLOGY
177	ECONOMIC AND SOCIAL SCIENCES	240	FOREST POLICY, FOREST MANAGEMENT
178	ECONOMICS IN AGRICULTURE/FORESTRY/RURAL DEVELOPMENT	241	FOREST PROTECTION
179	ECONOMICS OF DEVELOPMENT/GROWTH/INNOVATION	242	FOREST SCIENCES
180	ECONOMICS, ECONOMIC PLANNING	243	FORMAL SAFETY AND ENVIRONMENTAL ASSESSMENT
181	ECOSYSTEM RESEARCH AND CONSERVATION	244	FREIGHT TRANSPORT
182	ECOTOXICOLOGY	245	FUEL CELLS
183	EDUCATION AND TRAINING, LIFELONG LEARNING, REMOTE LEARNING	246	FUELS: ALTERNATIVE FUELS IN TRANSPORTS
184	EDUCATIONAL MULTIMEDIA	247	FUNCTIONAL FOODS
185	EDUCATIONAL SCIENCES	248	FUNGI
186	ELECTRICAL ENGINEERING/TECHNOLOGY	249	FUTURE AND EMERGING TECHNOLOGIES
187	ELECTROMAGNETISM	250	GAS CONVERSION
188	ELECTRONIC COMMERCE, ELECTRONIC PAYMENT, ELECTRONIC SIGNATURE	251	GAS TURBINES FOR ENERGY CONVERSION
189	ELECTRONIC DATA INTERCHANGE	252	GASES, FLUID DYNAMICS, PLASMAS/ELECTRIC DISCHARGES
190	ELECTRONIC HEALTH RECORDS	253	GASTRO-ENTEROLOGY
191	ELECTRONIC PUBLISHING, AUTHORING TOOLS	254	GENDER ISSUES, GENDER STUDIES
192	ELECTRONICS, ELECTRONIC ENGINEERING	255	GENE THERAPY
193	EMERGENCY MANAGEMENT	256	GENERAL PATHOLOGY, PATHOLOGICAL ANATOMY
194	EMISSION	257	GENETIC COMPARATIVE ANALYSIS
		258	GENETIC ENGINEERING
		259	GENETIC MAPPING, GENE SEQUENCE
		260	GENETIC RESISTANCE
		261	GENETIC SELECTION
		262	GENETICALLY MODIFIED ORGANISMS
		263	GENETICS
		264	GENOMES, GENOMICS
		265	GEOGRAPHIC INFORMATION SYSTEMS
		266	GEOGRAPHY
		267	GEOLOGICAL ENGINEERING/GEOTECHNICS

268	GEOMETRY/TOPOLOGY	340	INTERNATIONAL COMMERCE/ECONOMICS
269	GEOPHYSICS, PHYSICAL OCEANOGRAPHY, METEOROLOGY, GEOCHEMISTRY, TECTONICS	341	INTERNATIONAL TREATIES / MULTILATERAL AGREEMENTS
270	GERONTOLOGY AND GERIATRICS	342	INTERNET TECHNOLOGIES
271	GLOBAL CHANGE: BIOGEOCHEMICAL AND HYDROLOGICAL CYCLES	343	INVERTEBRATES
272	GLOBAL CHANGE: CLIMATE CHANGE	344	JOURNALISM
273	GLOBAL CHANGE: HUMAN HEALTH	345	KNOWLEDGE ENGINEERING
274	GLOBAL CHANGE: LAND COVER AND DEGRADATION	346	LABOUR MARKET STUDIES/ECONOMICS
275	GLOBAL CHANGE: OZONE AND ATMOSPHERIC COMPOSITION	347	LAND USE PLANNING/LANDSCAPE/LANDSCAPE ARCHITECTURE
276	GLOBAL CYCLES OF ENERGY AND MATTER	348	LANGUAGE SCIENCES/ENGINEERING/TECHNOLOGY, LINGUISTICS
277	GREEN TECHNOLOGIES/CHEMICALS	349	LARGE SCALE GENERATION OF ELECTRICITY/HEAT
278	GRID CONNECTION	350	LASER TECHNOLOGY
279	HAZARDS: INDUSTRIAL	351	LAW: INTERNATIONAL / PRIVATE / PUBLIC
280	HAZARDS: NATURAL	352	LEARNING MECHANISMS
281	HEALTH AND POPULATION, HEALTH EDUCATION	353	LIBRARY SCIENCE/SYSTEMS
282	HEALTH FINANCING / ECONOMICS	354	LIFE CYCLE MANAGEMENT
283	HEALTH RISK EVALUATION	355	LIPIDS, STEROIDS, MEMBRANES
284	HEALTH SCIENCES/POLICIES/LAW	356	LIQUID BIOFUELS
285	HEALTH SERVICE MANAGEMENT	357	LOGISTICS
286	HEALTH SYSTEMS RESEARCH	358	LOW INPUT PRODUCTION
287	HEALTH, HEALTH PHYSICS	359	MACROECONOMICS (INCL. MONETARY ECONOMICS)
288	HETEROGENEOUS CATALYSIS	360	MACROMOLECULAR CHEMISTRY/NEW MATERIAL/SUPRAMOLECULAR STRUCTURES
289	HIGH CONTAINMENT, HIGH CONTAINMENT FACILITIES	361	MACROSOCIOLOGY
290	HIGH FREQUENCY TECHNOLOGY, MICROWAVES	362	MAINTENANCE MANAGEMENT
291	HIGH-THROUGHPUT SCREENING	363	MANAGEMENT OF ENTERPRISES
292	HISTOLOGY, CYTOCHEMISTRY, HISTOCHEMISTRY, TISSUE CULTURE	364	MANAGEMENT OF URBAN AREAS
293	HISTORY	365	MANAGEMENT STUDIES
294	HISTORY AND PHILOSOPHY OF SCIENCE AND MEDICINE	366	MARINE ECOSYSTEMS
295	HOME SYSTEMS	367	MARINE SCIENCES/MARITIME STUDIES
296	HORMONES	368	MARINE: INSTRUMENTATION AND UNDERWATER TECHNOLOGY
297	HORTICULTURE, ORNAMENTAL PLANTS	369	MARINE: OCEANOGRAPHY (PHYSICAL AND OPERATIONAL)
298	HUMAN FACTORS IN TRANSPORT	370	MARITIME SAFETY
299	HUMAN GENETICS	371	MARKET ANALYSIS/ECONOMICS/QUANTITATIVE METHODS
300	HUMAN RIGHTS	372	MARKET STUDY, MARKETING
301	HUMAN SCIENCES, HUMANITIES	373	MATERIALS TECHNOLOGY/ENGINEERING
302	HVAC SYSTEMS AND MANAGEMENT	374	MATHEMATICAL ANALYSIS/PARTIAL DIFFERENTIAL EQUATIONS
303	HYBRID AND ELECTRIC VEHICLES	375	MATHEMATICAL LOGIC: SET THEORY, COMBINATORICS/SEMANTICS
304	HYDROBIOLOGY, MARINE BIOLOGY, AQUATIC ECOLOGY, LIMNOLOGY	376	MATHEMATICAL PHYSICS
305	HYDROCARBONS EXPLORATION AND PRODUCTION	377	MATHEMATICS
306	HYDROELECTRICITY/SMALL HYDRO/HYDROPOWER	378	MECHANICAL ENGINEERING, HYDRAULICS, VIBRATION AND ACOUSTIC ENGINEERING
307	HYDROGEN	379	MEDIA STUDIES/LAW/MASS COMMUNICATIONS
308	HYDROGEOLOGY, GEOGRAPHICAL AND GEOLOGICAL ENGINEERING	380	MEDICAL ANTHROPOLOGY
309	IDENTIFICATION SYSTEMS	381	MEDICAL SCIENCES/RESEARCH
310	IMAGING, IMAGE PROCESSING	382	MEDICAL TECHNOLOGY
311	IMMUNOLOGY, IMMUNOTHERAPY, IMMUNOASSAYS	383	MEDICINAL CHEMISTRY
312	IN VITRO TESTING/TRIAL METHODS	384	MEDICINE (HUMAN AND VERTEBRATES)
313	INDUSTRIAL ENGINEERING	385	MEMBRANE TECHNOLOGY
314	INDUSTRIAL POLICY/RELATIONS	386	MENTAL STRESS
315	INDUSTRIAL PSYCHOLOGY/SOCIOLOGY	387	METABOLIC REGULATION AND SIGNAL TRANSDUCTION
316	INDUSTRIAL TECHNOLOGY/ECONOMICS	388	METAL TECHNOLOGY AND METAL PRODUCTS
317	INFECTIONS	389	METALLURGY
318	INFORMATICS	390	METROLOGY, PHYSICAL INSTRUMENTATION
319	INFORMATICS LAW	391	MICROBIAL BIOTECHNOLOGY, MICROBIAL MODELLING
320	INFORMATION MANAGEMENT	392	MICROBIAL SYSTEMATICS/DIVERSITY
321	INFORMATION TECHNOLOGY/SCIENCE	393	MICROBIOLOGY
322	INFRASTRUCTURE MANAGEMENT	394	MICROECONOMICS (THEORETICAL AND APPLIED)
323	INLAND NAVIGATION	395	MICROELECTRONICS
324	INNOVATION ASSISTANCE	396	MICROENGINEERING, MICROMACHINING
325	INNOVATION FINANCE	397	MICROSYSTEMS
326	INNOVATION MONITORING	398	MINING
327	INNOVATION POLICY/STUDIES	399	MOBILE COMMUNICATIONS
328	INNOVATION TRAINING	400	MODELLING/MODELLING TOOLS, 3-D MODELLING
329	INORGANIC CHEMISTRY	401	MOLECULAR BIOLOGY
330	INSECTS	402	MOLECULAR BIOPHYSICS
331	INSTRUMENTATION TECHNOLOGY	403	MOLECULAR DESIGN, DE NOVO DESIGN
332	INTANGIBLE INVESTMENTS	404	MOLECULAR EVOLUTION
333	INTEGRATED ENVIRONMENTAL ASSESSMENT	405	MOLECULAR GENETICS
334	INTEGRATED GLOBAL SAFETY	406	MOLECULAR MARKERS AND RECOGNITION
335	INTEGRATION OF RENEWABLE ENERGY SYSTEMS	407	MONOCLONAL ANTIBODIES
336	INTELLECTUAL PROPERTY	408	MOTHER AND CHILD HEALTH
337	INTELLIGENT AGENTS		
338	INTELLIGENT VEHICLES AND WATERBORNE TRANSPORT SYSTEMS		
339	INTERMODAL TRANSPORT		

409	MOTORS AND PROPULSION SYSTEMS	478	PHYSICAL CHEMISTRY/SOFT MATTER
410	MOUNTAIN AND HIGHLAND ECOSYSTEMS	479	PHYSICAL GEOGRAPHY, CARTOGRAPHY, CLIMATOLOGY
411	MULTIMEDIA	480	PHYSICAL MEDICINE, KINESITHERAPY, REVALIDATION, REHABILITATION
412	MULTISENSORY TECHNOLOGY, MULTI-SENSING	481	PHYSICAL SCIENCES
413	MUSEUM SCIENCE	482	PHYSICAL STRESS
414	MYCOLOGY	483	PHYSICS OF FLUIDS
415	NANOBIOLOGY	484	PHYSIOLOGICAL DISORDERS
416	NANOFABRICATION, NANOTECHNOLOGY	485	PHYSIOLOGY
417	NARROW BAND TECHNOLOGIES	486	PHYTOREMEDIATION
418	NATURAL GAS	487	PHYTOTECHNOLOGY, PHYTOPATHOLOGY, CROP PROTECTION
419	NATURAL HISTORY OF DISEASES	488	PIPELINE TECHNOLOGY
420	NATURAL OILS, FATS AND WAXES	489	PLANT AND ASSOCIATED MICROORGANISM BIOTECHNOLOGY
421	NATURAL RESOURCES EXPLORATION	490	PLANT BIOCHEMISTRY
422	NATURAL SCIENCES	491	PLANT BIOLOGY
423	NEMATODS	492	PLANT GENETICS/SELECTION/BREEDING
424	NETWORK TECHNOLOGY, NETWORK SECURITY	493	PLANT HEALTH/PROTECTION
425	NETWORKED ORGANISATIONS	494	PLANT INPUTS/NUTRITION/PRODUCTION
426	NEUROBIOLOGY, NEUROCHEMISTRY, NEUROLOGY, NEUROPSYCHOLOGY, NEUROPHYSIOLOGY	495	PLANT PHYSIOLOGY
427	NEUROINFORMATICS	496	PLANT PRODUCTS
428	NEUTRON PHYSICS	497	POLITICAL SCIENCES/THEORY/ECONOMY/COMPARATIVE POLITICS
429	NEW MEANS OF TRANSPORT	498	POLYMER TECHNOLOGY, BIOPOLYMERS
430	NITROGEN FIXATION	499	POPULATION GENETICS
431	NOISE AND VIBRATIONS	500	PORT MANAGEMENT
432	NON-COMMUNICABLE DISEASES	501	POSITIONING AND GUIDANCE SYSTEMS
433	NON-LINEAR DYNAMICS AND CHAOS THEORY	502	POST HARVEST TREATMENT - FOOD
434	NON-METALLIC MINERAL TECHNOLOGY	503	POST HARVEST TREATMENT - NON-FOOD
435	NUCLEAR CHEMISTRY	504	PRECISION ENGINEERING
436	NUCLEAR ENGINEERING AND TECHNOLOGY	505	PRION DISEASES
437	NUCLEAR MEDICINE, RADIOBIOLOGY	506	PROBABILITY THEORY
438	NUCLEAR PHYSICS	507	PROCESS EFFICIENCY
439	NUCLEIC ACID METABOLISM	508	PROCESS ENGINEERING
440	NUCLEIC ACIDS, POLYNUCLEOTIDES, PROTEIN SYNTHESIS	509	PRODUCTION TECHNOLOGY
441	NUMBER THEORY, FIELD THEORY, ALGEBRAIC GEOMETRY, GROUP THEORY	510	PROGRAMMING/INFORMATION SYSTEMS
442	NUTRITION	511	PROJECT ENGINEERING
443	OBSERVATION SYSTEMS / CAPACITY / DATASETS / INDICATORS	512	PROTEINS, ENZYMOLOGY, PROTEIN ENGINEERING
444	OCCUPATIONAL HEALTH, INDUSTRIAL MEDICINE	513	PROTEOMES, PROTEOMICS
445	OCEAN / ENERGY	514	PSYCHIATRY, MEDICAL PSYCHOLOGY, PSYCHOSOMATICS
446	ODONTOLOGY, STOMATOLOGY	515	PSYCHOLOGICAL SCIENCES, PSYCHOLOGY
447	OFFSHORE TECHNOLOGY, SOIL MECHANICS, HYDRAULIC ENGINEERING	516	PUBLIC ADMINISTRATION
448	ON-LINE INFORMATION SERVICES, ON-LINE DEMOCRACY, ON-LINE BUSINESS	517	PUBLIC HEALTH
449	OPERATIONS RESEARCH, ACTUARIAL MATHEMATICS	518	PUBLIC PERCEPTION, PUBLIC RELATIONS
450	OPTICAL MATERIALS	519	PUBLIC POLICY STUDIES
451	OPTICS	520	PUBLISHING
452	OPTRONICS	521	PULP TECHNOLOGY
453	ORGANIC CHEMISTRY	522	QUALITY, QUALITY CONTROL, TRACEABILITY
454	ORGANIC FARMING	523	QUANTUM INFORMATION PHYSICS
455	ORGANIC WASTE	524	QUANTUM MECHANICS
456	ORGANOMETALLIC CHEMISTRY	525	QUANTUM TECHNOLOGY
457	ORPHAN DRUGS	526	R&D POLICY AND PROGRAMME EVALUATION AND IMPACT ASSESSMENT
458	OTHER RENEWABLE ENERGY OPTIONS	527	RADIODIAGNOSTICS, RADATION BIOLOGY
459	OTORHINOLARYNGOLOGY, AUDIOLOGY, AUDITIVE SYSTEM AND SPEECH	528	RADIOECOLOGY
460	PALEOCLIMATOLOGY	529	RAILWAY TRANSPORT TECHNOLOGY
461	PALEONTOLOGY/PALEOECOLOGY	530	REACTION MECHANISMS AND DYNAMICS
462	PAPER TECHNOLOGY, RECYCLING	531	REACTOR SAFETY
463	PARASITOLOGY (HUMAN AND ANIMAL)	532	REFERENCE MATERIALS/METHODS
464	PARTICLE PHYSICS/FIELDS THEORY	533	REFRIGERATION AND COOLING
465	PASSENGER TRANSPORT	534	REGIONAL ECONOMICS/STUDIES/DEVELOPMENT
466	PATENTS, COPYRIGHTS, TRADEMARKS	535	REHABILITATION SYSTEMS
467	PATHOLOGY	536	REMOTE SENSING
468	PATHOPHYSIOLOGY	537	REPRODUCTIVE HEALTH
469	PERIPHERALS TECHNOLOGIES (MASS DATA STORAGE, DISPLAY TECHNOLOGIES)	538	REPRODUCTIVE MECHANISMS
470	PERI-URBAN AGRICULTURE	539	RESEARCH METHODOLOGY IN SCIENCE
471	PESTICIDES, BIOPESTICIDES	540	RESEARCH NETWORKING
472	PETROCHEMISTRY, PETROLEUM ENGINEERING	541	RESEARCH POLICY
473	PETROLOGY, MINERALOGY, GEOCHEMISTRY	542	RESERVOIR CHARACTERISATION AND MONITORING
474	PHARMACEUTICALS AND RELATED TECHNOLOGIES	543	RESIDUES
475	PHARMACOLOGICAL SCIENCES, PHARMACOGNOSY, TOXICOLOGY	544	RESPIRATORY SYSTEM
476	PHOTONIC NETWORKS	545	RE-STRUCTURING OF PUBLIC ADMINISTRATIONS
477	PHOTOVOLTAIC SYSTEMS, CELLS AND MODULES MANUFACTURING, TECHNOLOGY DEVELOPMENT	546	ROAD SAFETY
		547	ROAD TRANSPORT TECHNOLOGY
		548	RTD SYSTEMS AND POLICIES AND THEIR INTERACTION WITH OTHER RELATED POLICIES
		549	RURAL DEVELOPMENT, RURAL SOCIOLOGY AND SOCIO-ECONOMICS

550	SAFETY TECHNOLOGY	620	TOXICITY AND TOXINOLOGY
551	SAMPLE BANKS	621	TRACTION/PROPULSION SYSTEMS
552	SATELLITE (TECHNOLOGY, SYSTEMS, POSITIONING, COMMUNICATION)	622	TRAFFIC CONTROL SYSTEMS
553	SCIENCE AND TECHNOLOGY INDICATORS	623	TRAFFIC ENGINEERING/INFRASTRUCTURE/MANAGEMENT SYSTEMS
554	SCIENCE POLICY	624	TRANSACTION SYSTEMS
555	SCIENCE, TECHNOLOGY AND THE MEDIA	625	TRANSGENE EXPRESSION
556	SEA FOOD	626	TRANSGENIC CROP PLANT
557	SEARCH AND RESCUE	627	TRANSHIPMENT SYSTEMS
558	SECURITY SYSTEMS	628	TRANSPORT DEMAND MANAGEMENT
559	SEMICONDUCTOR PHYSICS AND TECHNOLOGIES	629	TRANSPORT ECONOMICS
560	SENSORY SCIENCE, SENSORS, INSTRUMENTATION	630	TRANSPORT INFORMATION SYSTEMS, FLEET MANAGEMENT
561	SEROLOGY AND TRANSPLANTATION	631	TRANSPORT INFRASTRUCTURE/MANAGEMENT SERVICES
562	SET ASIDE	632	TRANSPORT MODELLING/SCENARIOS
563	SIGNAL PROCESSING	633	TRANSPORT OF GAS AND LIQUID FUELS
564	SILVICULTURE, FORESTRY, FOREST TECHNOLOGY	634	TRANSPORT POLICY/LAW
565	SIMULATION, SIMULATION ENGINEERING	635	TRANSPORT SAFETY/SECURITY
566	SIMULATOR TRAINING	636	TRANSPORT TECHNOLOGY/ENGINEERING
567	SKELETON, MUSCLE SYSTEM, RHEUMATOLOGY, LOCOMOTION	637	TRANSPORT TELEMATICS
568	SMART CARDS	638	TRANSPORT, TRANSMISSION AND DISTRIBUTION OF ELECTRICITY
569	SOCIAL ECONOMICS	639	TROPICAL AGRICULTURE
570	SOCIAL LAW	640	TROPICAL ECOSYSTEMS
571	SOCIAL MEDICINE	641	TROPICAL FORESTRY
572	SOCIAL SHAPING OF TECHNOLOGY	642	TROPICAL MEDICINE
573	SOCIETAL BEHAVIOUR	643	URBAN DEVELOPMENT/ECONOMICS
574	SOCIO-ECONOMIC ASPECTS OF ENVIRONMENTAL CHANGE	644	URBAN FORESTRY
575	SOCIO-ECONOMIC RESEARCH	645	URBAN GOVERNANCE AND DECISION MAKING
576	SOCIO-ECONOMICAL IMPACTS IN AGRICULTURE/FORESTRY/RURAL DEVELOPMENT	646	URBAN QUALITY OF LIFE
577	SOCIO-ECONOMICS	647	URBAN SOCIOLOGY
578	SOCIOLOGY	648	URBAN TRANSPORT
579	SOFTWARE ENGINEERING, MIDDLEWARE, GROUPWARE	649	URBAN: SUSTAINABLE CITIES AND RATIONAL RESOURCE MANAGEMENT
580	SOIL SCIENCE, AGRICULTURAL HYDROLOGY, WATER PROCESSES	650	URBAN: TECHNOLOGIES FOR THE BUILT ENVIRONMENT
581	SOLAR CONCENTRATING TECHNOLOGIES AND APPLICATIONS	651	UROLOGY, NEPHROLOGY
582	SOLID STATE PHYSICS	652	USER CENTRED DESIGN, USABILITY
583	SOUND ENGINEERING/TECHNOLOGY	653	USER MODELLING
584	SPACE TECHNOLOGY	654	VACCINES
585	SPATIAL INTEGRATION IN BUILT ENVIRONMENT	655	VACUUM/HIGH VACUUM TECHNOLOGY
586	SPEECH COMMUNICATION	656	VEHICLE TECHNOLOGY
587	SPEECH PROCESSING/TECHNOLOGY	657	VENTURE CAPITAL
588	STANDARDISATION, STANDARDISATION OF NEW TECHNOLOGIES	658	VESSEL TRAFFIC MANAGEMENT
589	STATISTICAL PHYSICS	659	VETERINARY MEDICINE
590	STATISTICS	660	VIRTUAL ORGANISATIONS
591	STRUCTURAL BIOLOGY/DETERMINATION/FUNCTION	661	VIRTUAL REALITY
592	SUPERCONDUCTORS	662	VIRUS, VIROLOGY
593	SURFACE CHEMISTRY	663	VULCANOLOGY/SEISMOLOGY
594	SURFACE PHYSICS	664	WASTE BIOTREATMENT
595	SURVEILLANCE	665	WASTE MANAGEMENT/RECYCLING
596	SURVEYING	666	WATER RESOURCE MANAGEMENT/ENGINEERING
597	SYNTHESIS AND NEW MOLECULES	667	WATER TRANSPORT TECHNOLOGY, SHIPBUILDING
598	SYSTEMS ANALYSIS AND MODELS DEVELOPMENT	668	WATER: FRESH WATER ECOSYSTEMS
599	SYSTEMS DESIGN/THEORY	669	WATER: HYDROLOGY
600	SYSTEMS ENGINEERING	670	WATER: MONITORING / QUALITY / TREATMENT
601	SYSTEMS, CONTROL, MODELLING, AND NEURAL NETWORKS	671	WATER: RATIONAL AND EFFICIENT USE
602	TECHNOLOGICAL SCIENCES	672	WATERBORNE TRANSPORT
603	TECHNOLOGY ACCEPTABILITY	673	WAVE/TIDAL ENERGY
604	TECHNOLOGY ASSESSMENT AND FORESIGHT	674	WEEDS
605	TECHNOLOGY EVALUATION/MANAGEMENT	675	WELFARE STUDIES
606	TECHNOLOGY POLICY	676	WETLAND ECOSYSTEMS
607	TECHNOLOGY TRANSFER	677	WIND ENERGY MANUFACTURING/TECHNOLOGIES
608	TECHNOLOGY WATCH/VALIDATION	678	WIND TURBINE ENVIRONMENTAL IMPACT
609	TELECOMMUNICATION ENGINEERING/TECHNOLOGY	679	WIRELESS SYSTEMS, RADIO TECHNOLOGY
610	TELESERVICES, TELE-WORKING, TELE-PAYMENT, TELE-MEDICINE	680	WOMEN'S STUDIES
611	TESTING, CONFORMANCE TESTING	681	WOOD ENGINEERED PRODUCTS, PARTICLE AND FIBRE BOARDS
612	TEXTILES TECHNOLOGY	682	WOOD PROCESSING BY MECHANICAL MEANS
613	THERAPEUTIC SUBSTANCES	683	WORLD TRADE ORGANISATION
614	THERMAL ENGINEERING, APPLIED THERMODYNAMICS		
615	THERMODYNAMICS		
616	TIMBER ENGINEERING		
617	TISSUE BANKS/ENGINEERING		
618	TOTAL QUALITY MANAGEMENT		
619	TOWN AND COUNTRY PLANNING		

**ANNEX 2: NACE codes for business activities**

<b>Division</b>	<b>Description</b>
<i>Section A</i>	<i>Agriculture, hunting and forestry</i>
01	Agriculture, hunting and related service activities
02	Forestry, logging and related service activities
<i>Section B</i>	<i>Fishing</i>
05	Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing
<i>Section C</i>	<i>Mining and quarrying</i>
10	Mining of coal and lignite; extraction of peat
11	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying
12	Mining of uranium and thorium ores
13	Mining of metal ores
14	Other mining and quarrying
<i>Section D</i>	<i>Manufacturing</i>
15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastic products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office machinery and computers
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semi-trailers
35	Manufacture of other transport equipment
35.1	Building and repairing of ships and boats
35.2	Manufacture of railway and tramway locomotives and rolling stock
35.3	Manufacture of aircraft and spacecraft
a	<i>Manufacture of helicopter</i>
b	<i>Manufacture of aeroplanes for the transport of goods or passengers, for use by the defence forces, for sports or other purposes</i>
c <sup>1</sup>	<i>Manufacture of parts and accessories of the aircraft of this class</i>

<sup>1</sup> Includes: major assemblies such as fuselages, wings, doors, control surfaces, landing gear, fuel tanks, nacelles, airscrews, helicopter rotors and propelled rotor blades, motors and engines of a kind typically found on aircraft, parts of turbojets and turbopropellers

## GLOSSARY

- Partners:** The term “partners” usually means the contractual partners within a Community-funded RTD project. These are sometimes termed “internal partners” to distinguish them from external partners, sometimes necessary for further dissemination and use
- Exploitation:** Use of available results by yourself or others for creating and marketing a product or process or for creating and providing a service
- Dissemination:** Divulging of knowledge (other than publication) resulting from knowledge protection formalities with a view to promoting scientific and technical progress
- Deliverable:** What is produced during the execution of the contract (be it document, guidelines, software code, product, samples, prototype, certified material, standard, etc.). A deliverable is usually conceived to allow the transition from one workpackage to another or to be exchanged between partners.
- Report:** Management tool aiming at informing – the partners and the European Commission – of the progress of the work and of the deliverables.
- RTD result:** Product, process, service, know-how, methodology or software achieved thanks to the RTD project and which arises from the completion of all deliverables. This RTD result is described confidentially in the Final Technical Report and, non-confidentially, in the Technological Implementation Plan (TIP), together with the planning for its dissemination and use.
- Project outputs:** Set of benefits generated by the project, i.e. the RTD results first, but also patents, publications, standards, etc. This set of outputs is collected through the T.I.P.
- Impacts:** Set of direct and indirect consequences – scientific, technical and socio-economic – due to the projects outputs and, furthermore, to their use and dissemination. These impacts will be measured at the end of the projects and 3 to 5 years after with an appropriate methodology (carried out by external experts).
- Categories:** Results can be any marketable or transferable product, process, service, standard, know-how, methodology, network experience, result of clinical trial or software. Project results fall into three basic categories, depending on your intention for dissemination and use (you can have a set of results of different categories):
- Category A:** *Externally usable results.* These are of commercial, social or scientific interest, but you do not intend to use them exclusively, or you do not have sufficient resources within your consortium. It is of mutual interest to make information on such results available for dissemination and further use at European level.
- Category B:** *Internally usable results.* These are of commercial, social or scientific interest to all or some partners who will use or disseminate them exclusively themselves. The writing of the Technological Implementation Plan will therefore help the partners to clarify and detail their strategy. The TIP would also help the Commission services to advise and check how they plan to do it
- Category C:** *Non-usable results.* These might be of interest to other researchers in particular if the TIP helps to identify R&D routes that are unfruitful.