Netherlands Quality Agency
NQA

Hanzehogeschool Groningen
University of Applied Sciences

Hanzehogeschool Groningen
University of Applied Sciences

Advanced Sensor Applications

Limited Study Programme Assessment

January 2013

Introduction

This is the assessment report of the hbo-bachelor Advanced Sensor Applications degree programme offered by Hanzehogeschool Groningen. The assessment was conducted by an audit panel compiled by NQA commissioned by Hanzehogeschool Groningen. The panel has been compiled in consultation with the study programme and has been approved prior to the assessment process by NVAO. In this report Netherlands Quality Agency (NQA) gives account of its findings, considerations and conclusions. The assessment was undertaken according to the *Assessment frameworks for the higher education system* of NVAO (6 December 2010) and the *NQA Protocol 2011 for limited programme assessment*.

The site visit took place on the 3rd and 4th of December 2012.
The audit panel consisted of:
Mr prof.dr.ir. G. van Straten (chairperson, representative profession/discipline)
Mr dr.ir. B. Vanrumste (representative profession/discipline)
Ms ir. A. Diepeveen MBA (representative profession/discipline)
Mr A. de Vries BEng (student member)

Ms drs. P. Göbel, NQA-auditor, acted as secretary of the panel.

The study programme offered a critical reflection; form and content according to the requirements of the appropriate NVAO assessment framework and according to the requirements of the *NQA Protocol 2011*.
The panel studied the critical reflection and visited the study programme.
Critical reflection and all other (oral and written) information have enabled the panel to reach a deliberate judgement.

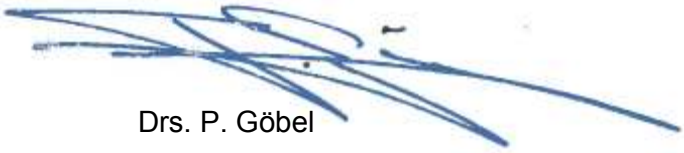
The panel declares the assessment of the study programme was carried out independently.

Utrecht, *February 2013*

Panel chairman

Prof. dr. ir. G. van Straten

Panel secretary



Drs. P. Göbel

Summary

The Bachelor Advanced Sensor Applications is a programme of the Hanze University of Applied Sciences. It is located in Assen. This four year programme prepares students for positions in the professional field where sensor technology is applied. Sensor technology is an enabling technology with applications in almost any area, but particularly in such areas as: health care services, sports, infrastructure, energy, agriculture, scientific research, consumer products and production companies. The main professional task of the Sensor Application Expert is to develop a sensor application based on the context, use and business. Graduates have a broad range of employment possibilities in positions such as design engineer, process control engineer, technical project leader, consultant, R&D engineer and technical entrepreneur.

The panel has assessed the quality of the Bachelor programme and comes to the overall judgement that the programme is of **good** quality.

Standard 1
The ASA programme is based on four general engineering competences and five specific ASA competences that were discussed with representatives of the professional field. The panel is very pleased with the competencies and the competence breakdown in de Body of Knowledge and Skills (BoKS). They suit de ASA programme and are relevant for the professional field. Although the competencies cover a wide range of domains the panel agrees with ASA that by doing so students are introduced to the different fields where sensor technology is applied. It is of course important that depth and width are kept in balance. ASA keeps in close contact with representatives of the professional field through the Programme Advisory Committee and the many guest lecturers. They are closely involved in designing and executing the programme.

ASA is a unique bachelor programme with its focus on sensor technology. The first graduates have found employment in different companies as the panel learned during the visit. It is furthermore internationally oriented with English as the common language for students and lecturers from the Netherlands and from abroad.
Based on above mentioned considerations the panel comes to the judgement **good.**

Standard 2
The panel is convinced that the structure and the contents of the programme enable students to acquire the intended learning outcomes. The structuring of the contents in themes provide a good combination of theory and practice in the projects the students have to work on. The curriculum covers a broad range in the domain of sensor applications which offers students the opportunity to get acquainted with the field and also to specialise in a specific area. The panel takes note of the involvement of companies with the themes. The panel thinks this involvement could be expanded in order to achieve the ambitions of ASA, but also to ensure that students get more into contact with companies.

During the first year students get acquainted with basic sensor topics and basic research and entrepreneurial skills. The project themes in this year concern Health and Nature. In the second year the knowledge and skills are expanded to recording with sensors, control loops, the use of several parallel systems with data transmitted wirelessly and translating data into useful information. The themes in this second year are Sensing, Systems & Control, Sensor Networks and Meaningful Data. In the third year the focus is on research and entrepreneurial skills. In the fourth year students can specialise in either Research & Development or Entrepreneurship.

The panel is very pleased with the structure of the programme and the focus on students. Students can contact lecturers easily and according to the students they form a kind of family. The mentor monitors the progress of students. The lecturers are experts in their field. They are really involved with the students as the panel noticed during the visit.

The panel has found a coherent educational learning environment which is enhanced by the small scale of ASA, the building with good labs and the fact that lecturers and students all know each other. At ASA there is an international atmosphere in which students and lecturers stimulate each other. In this environment it is indeed possible to have an honours programme for all students although the panel has some doubts about making it compulsory for all students. The panel believes that the current set-up and organisation sets the scene for a larger number of students, but to really accommodate them will be a challenge as some of the advantages of the small scale will be lost.
Based on above mentioned considerations the audit team comes to the judgement **good.**

Standard 3
ASA has an assessment policy that works well. Depending on the contents and didactical approach in a theme different types of assessment are used. The panel is pleased to see a good balance between group assignments and individual work. The graduation project is always an individual project.

In the Theme Guides the methods of assessment, the literature and the learning outcomes are described. The assessment procedures and criteria are transparent and available to all students. Students know what to expect so the panel learned in interviews.

The panel is satisfied that ASA has succeeded in composing a programme with which students can realise the intended learning outcomes. The seven students who graduated in 2012 all showed the Bachelor's level in their graduation projects. According to the panel the quality of some of the projects exceeds the Bachelor's level, especially as those projects were done for critical companies. The panel judges the marks given by the supervisors as appropriate and well balanced.

The companies the students worked for were pleased with the results and with the quality of the reports. Some graduates were offered a position at the company where they did their final project.
Based on above mentioned considerations the audit team comes to the judgement **good.**

Contents

1 Basic data of the study programme

Administrative data of the study programme

1. Name study programme as in CROHO	Advanced Sensor Applications
2. Registration number in CROHO	30015
3. Orientation and level study programme	Hbo-bachelor
4. Number of study credits	240 EC
5. Graduation courses / 'tracks'	Entrepreneurship Rsearch & Development
6. Variant(s)	Fulltime
7. Location(s)	Assen
8. Previous year of audit visit and date decision NVAO	Previous visit: May 17th, 2008 Decision NVAO: June 12th, 2008

*) Associate Degree, if applicable

Administratieve institutional data

9. Name institute	Hanzehogeschool Groningen
10. Status institute	Funded
11. Result institute audit	Positive under certain conditions, May 9, 2012

Quantitative data regarding the study programme

(bron: 1cijferHO)						
uitval (%) uit het eerste jaar	2005	2006	2007	2008	2009	2010
voltijd (A)[1]	-	-	-	36%	14%	43%
uitval (%) uit de bachelor	2005	2006	2007	2008		
voltijd (B)[2]	-	-	-	0%	25 %	6%
rendement (%)[3]	2005	2006	2007	2008		
voltijd	-	-	-	78 %		

docentkwaliteit (aantal)[4]	hbo	master	PhD (PDEng)
voltijd	20%	80%	20% (40%)

docent–student ratio[5]	
voltijd	1 / 17,3

contacturen (aantal/week)[6]	1e jaar	2e jaar	3e jaar	4e jaar
voltijd	16	16	11	Afhankelijk van gekozen minor

1 (A) Het aandeel van het totaal aantal bachelorstudenten (eerstejaars ho) dat na één jaar niet meer bij de opleiding staat ingeschreven, zo mogelijk voor de laatste zes cohorten.

2 (B) Het aandeel van de bachelorstudenten die zich na het eerste studiejaar opnieuw bij de opleiding inschrijven (herinschrijvers) dat in de nominale studieduur zonder het diploma te hebben behaald alsnog uitvalt uit de opleiding, zo mogelijk voor de laatste drie cohorten.

3 Het aandeel van de bachelorstudenten die zich na het eerste studiejaar opnieuw bij de opleiding inschrijven (herinschrijvers) dat het bachelordiploma haalt in de nominale studieduur + één jaar, zo mogelijk voor de laatste drie cohorten. Cohort 2008 geeft cijfers weer na nominale studieduur.

4 Het aandeel docenten (onderwijzend personeel) met een master en het aandeel docenten met een PhD in het totaal aantal docenten (onderwijzend personeel). PDEng staat voor Professional Doctorate in Engineering.

5 De verhouding tussen het totaal aantal ingeschreven studenten en het totaal aantal fte's aan onderwijzend personeel van de opleiding in het meest recente studiejaar.

6 Het gemiddeld aantal klokuren per week aan geprogrammeerde contacttijd, voor ieder jaar van de opleiding. Dit is exclusief de (project- en practicum-) begeleiding door docenten die plaatsvindt op aanvraag van studenten en verplichte Honours seminars.

2 Assessment

The panel describes the findings, considerations and conclusions of each standard of the NVAO assessment framework. The final judgement concerning the study programme will be presented in chapter 3.

Standard 1 Intended learning outcomes

The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

Findings
Sensor technology is an enabling technology with applications in almost any area, but particularly in such areas as: health care services, sports, infrastructure, energy, agriculture, scientific research, consumer products and production companies. The main professional task of the Sensor Application Expert is to develop a sensor application based on the context, use and business. Furthermore it is crucial that the Sensor Application Expert chooses the right sensor or sensor system and creates meaningful information out of sensor data. Graduates have a broad range of employment possibilities in positions such as design engineer, process control engineer, technical project leader, consultant, R&D engineer and technical entrepreneur.

The professional profile, based on the national Bachelor of Engineering profile (*Profiel van de Bachelor of Engineering*, maart 2006), was discussed with the professional field of sensor technology when ASA (Advanced Sensor Applications) started as a bachelor's degree programme in 2008 (*Professional profile ASA*, version 3.0, August 2012). External partners include NAM/Shell, Astron, Philips, Priva, Grontmij, TNO, IJkdijk and Dome/IBM. The profile was evaluated in cooperation with industry in a job market scan in 2011. One of the conclusions was that model-based reasoning and simulation will become more important. ASA will adjust the professional profile in line with the current requirements and will implement the new profile in the curriculum.

The ASA curriculum is based on nine competencies (cf. Annex 1). There are four general engineering competencies, based on the product innovation cycle:

1. gaining insight into a task or problem definition
2. design of product, service or direction
3. planning of the implementation
4. implementing the plan of action

and five specific ASA competencies:

1. socially relevant innovation
2. applied research
3. providing technical advice
4. entrepreneurship
5. professional skills

The professional competencies are assessed on four levels. Level three represents the HBO Bachelor level. In the national Bachelor of Engineering profile a comparison is made between the engineering competences and the Dublin descriptors that shows that they represent HBO bachelor level. ASA focuses on talented students and therefore offers the specific competencies also on level four. Students who enter this programme all have to prove a level of excellence in at least two of the five ASA specific competencies on the fourth level. In 2010 the Executive Board of the Hanze University assigned an Honours status to the Bachelor programme ASA. This implies that all ASA graduates complete the Bachelor with Honours.

In the Body of Knowledge and Skills (BoKS) ASA has laid down for each theme (ref. Standard 2) the topics and the learning outcomes in relation to the learning lines and the level of the competencies. The recent update of the BoKS shows a clear insight into the learning outcomes. The panel appreciates this detailed competence break down.

At the moment the profile of the Bachelor of Engineering is being updated. The new profile forms an even better match with the ASA profile than the current one. Socially-relevant innovation, applied research, advice, management (entrepreneurship) and professional skills have been added more explicitly, similar to the ASA competencies. For international comparability the EUR-ACE Framework of Engineering Programmes is used. ASA differs in approach from traditional Engineering Bachelor programmes such as Electrical Engineering and Mechanical Engineering. ASA students are challenged to develop a critical attitude, question common truth, justify choices and selections, choose various perspectives, use theories from a variety of domains, focus on change and ‘new’ (innovative) solutions, and to be creative by thinking out the box in order to become T-shaped engineers. T-shaped engineers are focused on innovation, are ready to work in interdisciplinary teams and communicate well.

ASA has an international focus: the language of communication is English, the partner companies are internationally-oriented and about forty percent of the lecturers is from abroad. ASA students come from all over the world: almost forty percent originates from nine different countries.

Considerations and conclusion
The panel is very pleased with the competencies and the competence breakdown in de BoKS. They suit de ASA programme and are relevant for the professional field. Although the competencies cover a wide range of domains the panel agrees with ASA that by doing so students are introduced to the different fields where sensor technology is applied. It is of course important that depth and width are kept in balance. ASA keeps in close contact with representatives of the professional field through the Programme Advisory Committee and the many guest lecturers. They are closely involved in designing and executing the programme (ref. Standard 2).

ASA is a unique bachelor programme with its focus on sensor technology. The first graduates have found employment in different companies as the panel learned during the visit. It is furthermore internationally oriented with English as the common language for students and lecturers from the Netherlands and from abroad.

Based on above mentioned considerations the panel comes to the judgement **good.**

Standard 2 Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Findings
The Advanced Sensor Applications Bachelor programme consists of a first year foundation programme of 60 EC and a main phase of 180 EC, including a minor of 30 EC. Each year is divided into four periods of approximately ten weeks (years 1 and 2) or two periods of twenty weeks (years 3 and 4). The contents of a period are built up around themes.

Contents of the curriculum
During the first year students learn basic sensor topics and basic research and entrepreneurship skills. The themes are placed within different contexts to give shape to the exploratory character of the first year. The first year covers the following themes: Health, Nature & Agriculture, Industry & Energy and Society. Within a theme different subjects support students in tackling a problem. This setup gives students an idea of the type of approach to socially-relevant problems that form the basis of each theme in the curriculum.

In the second year students learn all aspects of recording with sensors, control loops, including feedback, the use of several parallel systems with data transmitted wirelessly from many sensor systems and translating large amounts of data into useful information. Through this students gain insight into the fundamental aspects of a sensor system, carried out in different contexts with real life cases from companies. The themes in the second year are: Sensing, Systems & Control, Sensor Networks and Meaningful Data.

In the third year research and entrepreneurial skills are explicitly incorporated. To be able to reach more depth, especially in the area of complexity in the application of sensor systems in applied research, there are two themes of twenty weeks. The first semester focuses on research and design of advanced sensor applications. Together with several companies and societal organisations different R&D projects lead to new concepts and/or applications. The second theme focuses on the commercialisation of a prototype. This includes more in-depth marketing and accounting subjects as well as product and process development methods to produce robust reliable sensor applications in mass quantities in an efficient way. This third year prepares students for the choice of a graduation line.

In the fourth year students specialise in either the Research & Development graduation line or the Entrepreneurship graduation line. Last year all students choose for the R&D graduation line. Through the minor students can either specialise in one of the chosen fields or broaden their knowledge and skills. So far ASA students have chosen as minors Sensitive Innovation, Zorg en Techniek, and Biomedical Engineering from the Hanze University, and Embedded Systems and Sustainable Energy Technologies at Delft University. For his graduation a student works individually on a research project.

For each theme ASA seeks cooperation with relevant companies in the field. ASA discusses the content of a theme and the professional tasks with representatives from these companies and assignments are constructed in collaboration with these representatives. Professionals from these companies join ASA as guest lecturers. The panel is impressed by the theme-approach which guarantees a good combination of theory and practice. The students the panel has interviewed were enthusiastic about this approach and confirmed that the gained knowledge can immediately be applied in a practical assignment and projects. In the third year students do projects for a company. ASA has not programmed an internship for students. The panel has some doubts whether the confrontations with the practical field are enough to prepare students for their graduation project and working life. During the interviews with students it was mentioned it takes students some time to get to know a company, the culture and the important contacts. The panel would like to see that students get more opportunities to be prepared for work in relation to a company, regarding these and other issues like how to handle confidentiality. This might be achieved by organising brainstorm sessions and meetings with the company where they work on projects in the third year.

During the themes students get acquainted with relevant aspects from the Body of Knowledge and Skills (content-based learning lines), such as Mathematics, Electronics/Sensors, Data Analyses, Programming and Robotics, Engineering Design, Physics, Chemistry, Biology, English, Project Management, Professional Skills, Research Skills and Entrepreneurship. The panel appreciates that ASA offers a broad range of subjects so students get an overview of the field of sensor applications. In the minors students have the opportunity to specialise in a particular application domain or to broaden their knowledge. During Professional Skills students learn how to solve a problem, but also how to work in a group.

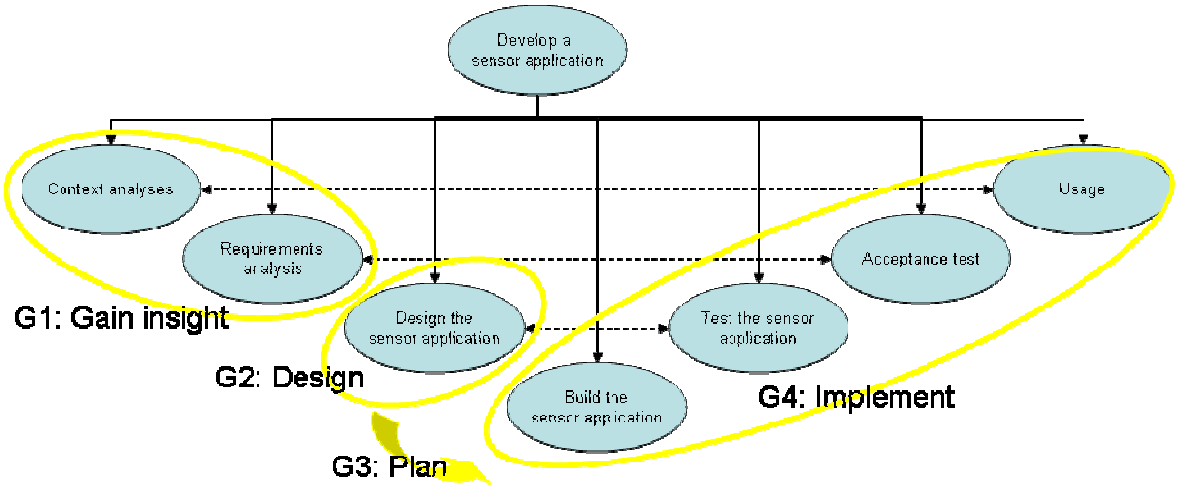
For each theme there is a Study Guide in which the goals and competences with indicators are explained and a list of relevant literature is offered. For each subject that contributes to the theme the contents are listed as well as the learning objectives.

Didactic concepts and methods

The programme differentiates four didactical lines: the integral, the conceptual, the training and the professional skills didactical line. The focus moves from conceptual and training in the first year (knowledge base) to integral in the fourth year.

The Sensor Application Expert's main professional task is to develop a sensor application based on the context, use and business. Part of this main professional task are two derivative professional tasks: choose the right sensor, based on context, use and business and create meaningful information out of sensor data. These are the three professional tasks of a Sensor Application Expert, focussing on the specific sensor application expert skills. Additional engineering tasks are of course also relevant.

According to the programme in the development of a sensor application the stages of the V-model should be completed. In the curriculum therefore the V-model is used as a standard model. Every project should complete the phases from this model, depending on the part of sensor application development the project covers. The stages of the V-model correspond with the competences. In the figure below the steps of the main professional task of the Sensor Application Expert are made explicit. Also the link between the professional task and the generic professional competencies of the Bachelor of Engineering is made transparent. The panel agrees with the choice for this model.



ASA is an Honours Bachelor. Thirty honours credits are interwoven into the curriculum in accordance with Hanze policy for Honours programmes (20 for research, 6 for the interdisciplinary line and 4 for the community line), and are included in the 240 credits of the four-year programme, thus making them compulsory for students. The honours lines are integrated in the Professional Skills didactical line. Although the panel is in favour of an honours programme it has some doubts as to making it compulsory for all students. This would imply that a student who does not comply with the honours requirements, will not be able to graduate as ASA-bachelor. This seems a rather rigid system to keep up. According to ASA these students switch to a regular Bachelor programme like Human Technology, Electrical Engineering or Technical Computer Science.

Focus on students

The panel concludes that there is a good focus on students. Lecturers are involved with the students. Individual student's matters are discussed within staff meetings that are held every two weeks. As a result the mentor can take quick and appropriate action when a student needs guidance. Formally a mentor and student meet twice a year.

In reality these meetings are more frequent and have a more informal character. Lecturers are easy to approach according to the students the panel has interviewed. The panel hopes that with the increase of the number of students ASA will be able to keep this focus on the students.

Forty percent of the students come from abroad. From the NSE 2012 it is clear that these students appreciate the programme and the assistance they get. The buddy system with senior students guiding first year international students will be further developed.

In the Digital Course Planner and in the digital learning environment Blackboard students can find all the necessary information, e.g. descriptions of each theme and each study unit. There is an overall study guide with information on the Dutch educational system, living in the Netherlands etc.

The number of contact hours per week in years 1 and 2 is in accordance with the target value of the Hanze University: 16 hours. But students spend far more time on their studies, even more than intended. The NSE survey from 2011 and 2012 show that the average ASA student spends between 44 and 55 hour per week on his studies. On the other hand the panel heard no complaints from students during the interviews. According to the students the workload is doable although there are some tough subjects like chemistry lab and Laplace transform.

At the start of the first year all students have to do some diagnostic tests: English, personality and motivation, professional competences, Physics, Mathematics, Chemistry and Biology. Students have the option to do a three-year Bachelor ASA-programme after passing an additional entry test. The panel learned that these students have no problems with adapting in the second year. To be able to better select students during the first year Mathematics was increased because it is needed as a basis for the second year.

Staff quality

The staff consists of people with various nationalities. Four of the ten lecturers are international and this meets the target of forty percent. Eight lecturers have a master degree and two hold a PDEng (the academic degree Professional Doctorate in Engineering) and two hold a PhD. Lecturers are employed not only because of their knowledge and skills in their field of expertise but also because of their experience in related industries. Most teaching staff have a teaching qualification but ASA aims at increasing this number.

The initiatives staff members take are an example for the students. The Professional Skills teacher introduced Theatre Sports and has published about the subject. Several lecturers volunteered to be the first participants in a Science Slam organised by students in which they competed with each other by presenting research in an accessible way.

The number of lecturers that participate in knowledge circles is increasing. One lecturer is connected to the Research Centre Talent Development in Higher Education and Society.

One professor and four lecturers participate in the Centre of Excellence for Intelligent Sensor Innovations (CENSI). One professor is connected to Noorderruimte, Centre of Applied Research and Innovation on Area Development.

ASA organises staff development, e.g. workshops on research skills, classes on working with learning outcomes and English classes for non-native speakers.

During the interviews students told the panel that they can contact the lecturers easily, that they are more or less one family. According to the students the lecturers are really involved with students and are willing to give extra lessons when needed.

Quality of study programme-specific facilities

ASA is located in Assen. Students can work in different labs: computer lab/electronics lab, mechanical lab and chemical lab. The need for an additional electronics lab is felt and will be set up in 2012-2013. The panel was shown around the facilities during the visit and found the labs in good order. From the NSE scores it is apparent that students are satisfied with these facilities. The scores on library and sports facilities are low because there are few Hanze facilities in Assen. There is no technical library available in Assen and the sports facilities in the area don't give student reductions. In the interviews students mentioned that they can order books on line from the library in Groningen but that they miss the sports facilities.

Educational quality assurance

The Curriculum Committee is responsible for the overall evaluation of the curriculum. The Curriculum Committee advises on the development of the curriculum in order to keep it state of the art. On the theme level the Theme Coordinator is responsible for the continuous improvement of education. Both the Curriculum Committee and the Theme Coordinator get input from evaluations among students. According to the students interviewed by the panel the management listens to comments from the students. The panel has read several improvement plans in which actions are listed.

Considerations and conclusion

The panel is convinced that the structure and the contents of the programme enable students to acquire the intended learning outcomes. The structuring of the contents in themes provide a good combination of theory and practice in the projects the students have to work on. The curriculum covers a broad range in the domain of sensor applications which offers students the opportunity to get acquainted with the field and also to specialise in a specific area. The panel takes note of the involvement of companies with the themes. The panel thinks this involvement could be expanded in order to achieve the ambitions of ASA, but also to ensure that students get more into contact with companies.

The panel is very pleased with the structure of the programme and the focus on students. Students can contact lecturers easily and according to the students they form a kind of family. The mentor monitors the progress of students. The lecturers are experts in their field. They are really involved with the students as the panel noticed during the visit.

The panel has found a coherent educational learning environment which is enhanced by the small scale of ASA, the building with good labs and the fact that lecturers and students all know each other. At ASA there is an international atmosphere in which students and lecturers stimulate each other. In this environment it is indeed possible to have an honours programme for all students although the panel has some doubts about making it compulsory for all students. The panel believes that the current set-up and organisation sets the scene for a larger number of students, but to really accommodate them will be a challenge as some of the advantages of the small scale will be lost.

Based on above mentioned considerations the audit team comes to the judgement **good.**

Standard 3 Assessment and achieved learning outcomes

The programme has an adequate assessment system in place and demonstrates that the intended learning outcomes are achieved.

Findings
Since the accreditation in 2008 ASA has continuously improved the frame of examinations and assessments. Guidelines for assessment, and testing the Honours level were developed. Last year ASA started to store the examinations, the corresponding assessment models and the feedback from colleagues on that in a digital Exam Archive.

Assessment system
ASA has a vision on examinations and assessments laid down in the Assessment Policy ASA (*Assessment and Examination Policy Advanced Sensor Applications*, HIT, 11-10-2012). The assessment policy includes guidelines for each didactical line because each line has its own targets and working methods. There is a system of collegial consultation, set up to assure the quality of the assessments. In 2011-2012 all written exams were screened by a professional colleague, the 'four-eye-principle'. In 2012-2013 the exams will be screened on basis of a pre defined format, to make the outcome more reliable.

The Examining Board has been strengthened in order to fulfil the responsibilities and authorities required by law. The Examining Board is responsible for the correct execution of the Teaching and Examinations Regulations, the Assessment Policy and the Graduation Regulations (*Jaarverslag studiejaar 2011-2012, 1 september 2011 tot en met 31 augustus 2012*, Examencommissie Hanze Institute of Technology, Hanzehogeschool Groningen). In other words it guarantees the final level of the students that graduate. The Assessment Committee and the Graduation Committee perform tasks delegated by the Examining Board. The Assessment Committee guards the assessment cycle: it checks the quality of assessments by performing audits. The Graduation Committee is responsible for the graduation protocol. It appoints the internal supervisors and it checks the proposals for the graduation projects.

In the Theme Guides the methods of assessment, the literature and the learning outcomes are described. The assessment procedures and criteria are transparent and available to all students. Students know what to expect so the panel learned in interviews with students, although they do not always read the Theme Guides well. Students have to prove a level of excellence on at least two of the five ASA specific competencies to be able to graduate with honours.

ASA uses different types of assessment like written and oral examinations, lab reports, performance during lab sessions, projects, presence during workshops, assignments, etc. The panel has studied assessments from different themes and concludes that all tests are of a high level. In order to demonstrate the level of professional skills the students have to collect evidence of their ability in a digital portfolio. The portfolio is preliminary assessed at the end of a theme and finally at the end of the year. During the visit the panel was shown an example of a digital portfolio and was impressed by the professional way it was executed. From students the panel learned that some of them have used the portfolio for job interviews. The panel has not been able to check all portfolios in regard to the honours requirements.

Feedback is mostly given orally. According to the students you can get written feedback when you ask for it. The panel ascertained that the culture of oral feedback works well. On the other hand when the number of students will increase the panel recommends to put the feedback in writing as well. Not every student is at ease with asking for written feedback. According to the students the feedback when writing the final report was very good, mostly on a weekly basis.

The graduation project is always an individual project, either carried out at a company, a research centre or in a student company start up situation. Students can seek an assignment or question within a company. The question or task is translated into a research proposal. The Graduation Committee checks the proposed graduation project for both consistency and suitability. The proposal must conform to a number of conditions that are published on Blackboard and in the Graduation Regulations (*Graduation Rules & Regulations 2011-2012*, version 1.0, December 2011). The check on the proposals is quite thorough, students sometimes have to rewrite a proposal several times before it is accepted. Students are coached by an internal supervisor and by a coach from the company.

The final grade consists of the final report (80 percent) and a presentation (20 percent). As conditional requirements students have to show a good performance and a complete portfolio. Next to the supervisor there is appointed a second supervisor who reads and assesses the final report and the graduation presentation. The final grade is established through weighing assessments from both supervisors and the professional skills teacher. The advice of the company coach is also taken into account.

In the summer of 2012 the first seven students graduated at ASA with honours.

Realisation of the intended learning outcomes

The panel has studied all seven final projects and was pleased to find them all of good quality. According to the panel the quality of some of the projects exceeds the Bachelor's level, especially as those projects were done for critical companies. There is an extensive checklist for grading the report and the presentation. The panel judges the marks given by the supervisors as appropriate and well balanced.

The final projects as well as the reports are well executed which show the students' development of professional skills. Although there is already a good check on the research proposal the panel recommends to focus even more on the suitability of a subject. The V-model (ref. Standard 2) could be more leading in this. To help students composing a report they have to use a template. According to the students the template was helpful and not too confining. Although the panel appreciates the use of a template it likes to stress that it is not suitable for every subject.

The seven graduate students choose the research profile rather than the entrepreneurship because they wanted to gain more technical knowledge. Students search themselves for a company to do their final project. They are stimulated by their supervisors to formulate their own research question and not take the company's questions for granted. According to the students the contact between the internal supervisor and the company supervisor could be intensified. Most projects are executed on location, but sometimes the students work on their project at school.

Considerations and conclusion

ASA has an assessment policy that works well. Depending on the contents and didactical approach in a theme different types of assessment are used. The panel is pleased to see a good balance between group assignments and individual work.

The panel is satisfied that ASA has succeeded in composing a programme with which students can realise the intended learning outcomes. The seven students who graduated in 2012 all showed the Bachelor's level in their graduation projects. The companies the students worked for were pleased with the results and with the quality of the reports. Some graduates were offered a position at the company where they did their final project.

Based on above mentioned considerations the audit team comes to the judgement **good.**

3 Final judgement of the study programme

Assessments of the standards

The audit team comes to the following judgements with regard to the standards:

Standard	Assessment
1 Intended learning outcomes	Good
2 Teaching-learning environment	Good
3 Assessment and achieved learning outcomes	Good

Considerations and conclusion

Weighing of the judgements with regard to the three standards based on the justification for the standards and according to the assessment rules of NVAO:

- The final conclusion regarding a programme can only be “good” if at least two standards are judged “good”; one of these must be standard 3.

The audit panel assesses the quality of the bachelor Advanced Sensor Applications of the Hanze University of Applied Sciences as **good**.

4 Recommendations

Standard 1:

- The panel should like to see that the Honours programme is not made compulsory. When all students have to show excellence it is no longer a distinctive element within the programme. It may, according to ASA, be a distinctive feature in comparison to other bachelor programmes.

Standard 2:

- The panel recommends the programme to expand the involvements of companies even more in order to achieve the ambitions of ASA, but also to ensure that students can have more interaction with companies.

Standard 3:

- The panel advises the programme to keep a close watch on the choice of the subjects (not too broad) for the final project as well as on the feasibility and the budget of the projects. The coaching of the students is an important factor especially with regard to the time available to realise the project.
- The panel ascertained that the culture of oral feedback works well. On the other hand when the number of students will increase the panel recommends the programme to put the feedback in writing as well. Not every student is at ease with asking for written feedback.

5 Annexes

Annex 1: Final qualifications of the study programme

The generic engineering professional competencies are related to the product innovation cycle, they can be applied in every product innovation situation. In the table below they are explained in more detail.

Generic professional competencies	Qualification at the end of the ASA course
G1. Gaining insight into task or problem definition	Student orients on the socially-relevant context and analyses the problem or client question within the field of sensor technology by autonomously searching and using relevant knowledge. Student establishes or reformulates a (client) question and presents a motivated choice for a provisional direction of solution of the problem by developing a requirement analysis for an advanced sensor application.
G2. Design of product, service or direction	Student drafts the re-formulated question and provides a description of the possible solutions to solve the problem based on relevant knowledge and research results. Student drafts one or more designs of a sensor application by presenting a conceptual model or prototype and provides justifiable advice to the client on which design the client should select.
G3. Planning of the implementation	Student drafts the plan that is chosen in a detailed way; taking into account the technical, financial and commercial feasibility of the sensor application. Student translates the detailed design of the sensor application in terms of time, money and organisation for different phases of the implementation by developing a project phasing plan and detailed resources estimation.
G4. Implementing the plan of action	Student realises the sensor application or service through implementing (or outsourcing implementation) the plan of action, in a context where unexpected problems or situations can occur. Student evaluates the implementation of the sensor application or the service by using results from integration tests, verification tests and user acceptance tests.

Next to the engineering professional competencies, the Advanced Sensor Applications bachelor course has five additional professional competencies. Pinpointing the specific professional competencies this bachelor course puts emphasis on. They are called S1 till S5 and are described in the table below.

These professional competencies are assessed at 4 levels. The 3rd level is the level of HBO bachelor. The 4th level is the ‘excellent’ level (level 4), since ASA is focused on talented students. A student has to complete at least 2 of the 5 Specific Professional Competencies at ‘excellent’ level.

Specific professional competencies	Level	Qualification at the end of the ASA course
S1 Socially relevant innovation	3	Student develops sensor applications either on own initiative as well as in response to clients' request. Student finds original solutions for problems in a changing society and links them to the professional field of sensor technology by extending the framework of the student's direct environment.
	4	Student develops innovative sensor applications or products to solve a socially relevant problem by looking into a wider context than the clients' request and takes into account that the product is socially relevant, sustainable, durable, considers lifecycle and ethical aspects. Student finds original solutions for problems in a changing society and links them to the professional field of sensor technology by extending the international research framework.
S2 Applied research	3	Student selects relevant information in an independent and responsible way and carries out research with justified choices around the use of sensors. Student contributes to the development of the industry by applying existing knowledge on sensors in a new domain.
	4	Student selects and is critical of relevant information in an independent and responsible way and carries out research with justified choices around the use of sensors. Student contributes to the development of the industry by applying a high amount of complexity in a task (new domain and/or diversity of functions and/or sources and/or new technology and/or new methodology). Student demonstrates usage of new knowledge (not acquired earlier in the programme).
S3 Providing technical advice	3	Student formulates comprehensive and well-founded recommendations on the application of sensors, based on research, analysis and actual overview of the professional field, taking into account social relevant aspects and presents these recommendations in a convincing way to those concerned by showing dedication and decisiveness. Student provides a match between the client's needs and the advice being given. Student is able to find the deeper lying questions of the client.
	4	Student formulates comprehensive and well-founded recommendations for complex problems based on all possible sources in decision making, by showing a well developed feel for hierarchy and social relations and presents these recommendations in a charismatic and convincing way to those concerned by showing dedication and decisiveness on the basis of the available information. The recommendations are innovative, clear, and reliable and can be unexpected. Student provides an excellent match between the client's needs and the advice being given. Student is able to find the deeper lying questions of the client.

S4 Entrepreneurship	3	Student plans the execution of a new concept where intercultural and technical interdisciplinary aspects are taken into account, as well as commercial, organizational and chain-dependent interests. Student demonstrates the new concept within and outside the own work environment with professionals and clients.
	4	Student plans independently the execution of a new original business concept by writing a business plan that shows willingness to take calculated risks, and commercial, organizational and chain-dependent aspects. Student demonstrates persistence and great confidence in own capacities by the start-up of a new business concept. Students is always looking for new opportunities and taking appropriate action.
S5 Professional Skills	3	Student improves the effectiveness, efficiency and success of his/her professional actions by mirroring, taking initiative, showing creativity and self development and adjust actions accordingly. Student cooperates in a (multicultural) environment in order to reach organizational and personal goals by taking personal and cultural characteristics of the stakeholders and target group into account.
	4	Student improves the effectiveness, efficiency and success of own professional actions by showing awareness of own potential, taking initiative, showing creativity and self development in a productive and lasting manner and adjust actions accordingly. Student cooperates enthusiastically and respectfully in a (multicultural) environment in order to enhance organizational and personal goals by taking responsibility for organisational tasks and personal development.

Annex 2: Survey study programme

Year 1

year 1	**Theme 1** **Healthcare**	PC	EC	T	**Theme 2** **Nature and agriculture**	PC	EC	T
	1.1 Professional Skills 1	SAV18PFSP1	2	P	2.1 Professional Skills 2	SAV18PFSP2	2	P
	1.2 English 1	SAVP2ENG1	2		2.2 English 2	SAVP2ENG2	2	
	1.3 Physics & Maths 1	SAV11PHM1	2	E	2.3 Chemistry 2	SAV11CHM2	2	E
	Electronics 1	SAV11ELC1	1	E	Biology 2	SAV11BIO2	1	E
	Physics & Electronics – Practical 1	SAV11PEP1	1	R	Biology and Chemistry - Practical 2	SAV11BCP2	1	R
	1.4 Biology 1	SAV11BIO1	1	E	2.4 Mathematics			
	Chemistry 1	SAV11CHM1	1	E	2.5 Programming LV 2	SAV11MAT	2	E
	Biology and Chemistry – Practical 1	SAV11BCP1	1	R	2.6 Electronics 2	SAV10PLV2	1	R
	1.5 Programming LV 1	SAV10PLV1	1	R	2.7 Nature and agriculture Project	SAVP2ELC2	1	E
	1.6 Healthcare Project	SAV11HCP	3	PP		SAV11NAP	3	PP
	Total		**15**	**7**	**Total**		**15**	**6**

Year 1	**Theme 3** **Industry and Energy**	PC	EC	T	**Theme 4** **Society**	PC	EC	T
	3.1 Professional Skills 3	SAV18PFSP3	2	P	4.1 Professional Skills 4	SAV18PFSP4	2	P
	3.2 English 3	SAVP2ENG3	2		4.2 English 4	SAVP2ENG4	2	E
	3.3 Physics & Maths 2	SAV11PHM2	2	E	4.3 Physics & Maths 3	SAVP2PHM3	3	E
	Energy Practical	SAV11ENP	1	R	Physics Practical	SAV11PHPR	1	R
	3.4 Chemistry 3	SAV11CHM3	2	E	4.4 Biochemistry	SAV11BCH	2	E
	Chemistry Practical 3	SAV11CHP3	1	R	Biochemistry Practical	SAV11BCP	1	R
	3.5 Programming LV 3	SAVP2PLV3	1	R	4.5 Simulation	SAV10SIM	1	R
	3.6 Electronics 3	SAVP2ELC3	1	E	4.6 Society Project	SAV18SYPI4	3	PP
	3.7 Industry and Energy Project	SAV11IEP	3	PP				
	Total		**15**	**6**	**Total**		**15**	**6**

Notes:

P= Portfolio Grade: O/V
E= Exam Grade: Number (except for English: O/V)
R= Report Grade: Number
PP= Professional Product Grade: Number

Year 2

year 2	**Theme 5 Sensing**	PC	EC	T	**Theme 6 Systems & Control**	PC	EC	T
	5.1 Professional Skills 5	SAV29PFSP1	2	P	6.1 Professional Skills 6	SAV29PFSP2	2	P
	5.2 Electronics and Maths	SAV21ELM	3	E	6.2 Introduction to Control	SAV29ICLC2	3	E
	Electronics Practical	SAV29ELPT1	2	R	Control Systems Practical	SAV29CSPT2	2	R
	5.3 Sensors	SAV29SNSC1	2	E	6.3 Robotics & Physics	SAV29RPHC2	2	R
	5.4 Programming Java 1	SAV20PRJ1	2	R	6.4 Biology 3	SAV21BIO3	1	E
	5.5 Sensing Project	SAV29PRSI1	4	PP	6.5 Programming Java 2	SAV20PRJ2	2	R
					6.6 Systems & Control Project	SAV29PRRI2	3	PP
	Total		**15**	**5**	**Total**		**15**	**5**

Year 2	**Theme 7 Sensor Networks**	PC	EC	T	**Theme 8 Meaningful data**	PC	EC	T
	7.1 Professional Skills 7	SAV20PFS7	3	P	8.1 Professional Skills 8	SAV20PFS8	3	P
	7.2 Biology and Chemistry	SAV21BCH	2	E	8.2 Databases	SAV21DB	1	R
	7.3 Sensor Networks 1	SAV21SNW1	3	E	8.3 Statistics 1	SAV21STA1	1	E
	7.4 Programming Java 3	SAV20PRJ3	2	R	8.4 Digital Signal Processing	SAV22DSP	2	E
	7.5 Entrepreneurship 1	SAV22ENS1	2	R	Data Analysis	SAV22DAN	2	E
	7.6 Sensor Networks Project	SAV20PRN	3	PP	DSP Practical	SAV29DSPT4	2	R
					8.5 Visualisation Practical	SAV29VIST4	1	R
					8.6 Meaningful Data Project	SAV20PRM	3	PP
	Total		**15**	**4**	**Total**		**15**	**6**

Notes:

P= Portfolio Grade: O/V
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PP= Professional Product Grade: Number

Year 3

	Semester 5 (theme 9 & 10) Research and Development	PC	EC	T
year 3	9.1 Professional Skills 9	SAVH2PFS9	5	P
	9.2 Project R&D	SAVH2PRRD	8	PP
	9.3 Research Skills	SAVH2RSS	1	R
	9.4 Intelligent Sensors	SAVH2ISE	4	E+R
	9.5 Special Sensors	SAVH2SS	1	R
	9.6 Connectivity	SAVH2CON	2	E+R
	9.7 Choosing Sensors & Electronics	SAVH2CSE	2	E
	9.8 Statistics 2	SAV31STA2	2	E
	9.9 C Programming	SAVH2PRC	3	R
	9.10 Sensor Networks 2	SAVH2SNW2	2	R
	Total		**30**	**10**

	Semester 6 (theme 11 & 12) Business and Entrepreneurship	PC	EC	T
Year 3	1. Professional Skills 10	SAVH2PFS10	6	P
	2. Project Business & Entrepreneurship	SAVH2PRBE	9	PP
	3. User Interface Development	SAV31UID	2	R
	4. Methodical Design	SAVH2MDD	2	R
	5. Entrepreneurship 2	SAV31ENS2	1	R
	6. Reliability Engineering 1	SAVH2REN1	3	R
	7. Reliability Engineering 2	SAVH2REN2	3	E+R
	8. Operations Requirements	SAV31OPR	2	E
	9. Material Science	SAVH1MSC	1	E
	10. VCA	SAVH2VCA	1	E
	Total		**30**	**9**

Year 4: A student chooses one of the two graduation profiles in year 4: 'Research and Development' or 'Entrepreneurship'.

	Theme 13+14 **Minor options / specialisation**		PC	EC	T	**Theme 15+16** **Graduation**	PC	EC	T
year 4 Research & Development	13.1	Minor Sensitive Innovations	SAV49DGZI	29	PP	15.1 Graduation project Research and Development	SAV41RD	30	PP
	13.2	Professional Skills	SAV49DGZI SAV41PFS13	1	P				
	Total			**30**		**Total**		**30**	

	Theme 13+14 **Minor options / specialisation**		PC	EC	T	**Theme 15+16** **Graduation**	PC	EC	T
year 4 Entrepreneurship with Sensors	14.1	Minor Enterprise with Technology 1	IIVM0OVT1	14	PP	16.1 Graduation project Entrepreneurship	SAV41SUWS	30	PP
	14.2	Minor Enterprise with Technology 2	IIVM0OVT2	14	PP				
	14.3	Professional Skills Minor	SAV41PFSM	2	P				
	Total			**30**		**Total**		**30**	

Notes: P= Portfolio Grade: O/V E= Exam Grade: Number (except for English: O/V)
R= Report Grade: Number PP= Professional Product Grade: Number

Minor and Selective Subjects

Next to the preferred minors and selective subjects mentioned below, there is also the possibility to choose a different minor within certain criteria. A short list of possible minors is published on Blackboard under Hanze Institute of Technology > Official documents. This list is approved by the Examining Board.

	Sensitive Innovations	PC	EC	T
Minor	Sensitive Innovations	SAV49DGZI	29	PP
	Total		**29**	

	Sensitive Innovations	PC	EC	T
Selective subjects	Sensitive Innovations 1 Sensitive Innovations 2	SAV40KDZ SAV49DGZI	14 14	PP PP
	Total		**28**	

	Enterprise with Technology	PC	EC	T
Selective subjects	Enterprise with Technology1 Enterprise with Technology2	IIVM0OVT1 IIVM0OVT2	14 14	PP PP
	Total		**28**	

Notes: P= Portfolio Grade: O/V PP= Professional Product Grade: Number

Annex 3: Expertise members audit panel and secretary

De heer prof. dr. ir. G. van Straten

De heer Van Straten is ingezet vanwege zijn deskundigheid op het gebied van meet-, regel- en systeemtechniek en vanwege zijn inzicht in de internationale ontwikkelingen in dit werkveld. Hij is lid en voorzitter geweest van de Measurement and Control Section of the Royal Dutch Institute of Engineers; lid van de Advisory Board of the Dutch Foundation for Technological Research (STW); voorzitter (2003-2008) van de IFAC Technical Committee on Control in Agriculture. De heer Van Straten is hoogleraar wo bachelor & master (o.m. ten behoeve van de opleidingen agrotechnologie en bioprocestechnologie en MSc Aquatic Technology Leeuwarden). Als Associated Editor Control Engineering Practice (CEP) en Editor-in-Chief Computers and Electronics in Agriculture (COMPAG) beschikt hij over gezag en actuele vakkennis in zijn vakgebied. Voor deze visitatie heeft de heer Van Straten onze handleiding voor panelleden ontvangen en in een voorbereidende vergadering is hij aanvullend geïnstrueerd over het proces van visitatie en accreditatie in het hoger onderwijs en over de werkwijze van NQA.

Opleiding:
1986 Promotie aan de Universiteit Twente; dissertatie onderwerp:"Identification, uncertainty assessment and prediction in lake eutrophication" (promotors prof. J.E. Rijnsdorp en prof. L.Lijklema).
1964 – 1970 Chemische technologie TU Eindhoven
1958 – 1964 Gymnasium beta

Werkervaring:
2012 – heden Van Straten Agrodynamics Support
2011 – heden Emeritus Hoogleraar meet-, regel- en systeemtechniek
1990 – 2011 Hoogleraar Meet-, regel- en systeemtechniek Wageningen Universiteit
1981 – 1990 UHD Universiteit Twente, vakgroep Milieutechnologie en Systeemdynamica
1979 – 1980 Projectleider International Institute of Systems Analysis, Laxenburg, Oostenrijk
1971 – 1979 UD Universiteit Twente Chemische Technologie
1970 – 1971 militaire dienst

Diversen:
International consultancy, o.m. voor UNDP; Venetië
Outstanding Contribution Award of IFAC-CC Life Support Systems, July 2000
voormalig lid bestuursraad STW
organisator van 6 internationale congressen en meerdaagse workshops
meer dan 150 publicaties in internationale tijdschriften: zie
http:/www.sco.wur.nl/UK/Staff/stratenvan_gerrit/
auteur, co-auteur of redacteur van 7 boeken of proceedings
promotor van meer dan 25 promovendi
lid VIAS, NVTL, NVA, KIVI

De heer dr. ir. B. Vanrumste

De heer Vanrumste is ingezet vanwege zijn deskundigheid op het gebied van biomedische technologie en vanwege zijn inzicht in de internationale ontwikkelingen in dit werkveld. Binnen het vakgebied Biomedische Technologie doet hij onderzoek naar accelerometers voor de detectie van epilepsieaanvallen.

Hij heeft onderwijservaring als universitair docent Electrical Engineering (ESAT-SCD) aan de Katholieke Universiteit Leuven en als docent digitale signaal- en beeldverwerking aan de Katholieke Hogeschool Kempen en Katholieke Hogeschool Limburg. Hij beschikt over internationale deskundigheid als vice-voorzitter IEEE Engineering in Medicine and Biology Society Benelux Chapter en als lid van de International Society for Bioelectromagnetism. Voor deze visitatie heeft de heer Vanrumste onze handleiding voor panelleden ontvangen en in een voorbereidende vergadering is hij aanvullend geïnstrueerd over het proces van visitatie en accreditatie in het hoger onderwijs en over de werkwijze van NQA.

Opleiding:

1996 – 2001	Doctoraat in de Toegepaste Wetenschappen
1996 – 1998	Master Biomedische Technologie
1989 – 1994	Burgerlijk Elektrotechnisch Ingenieur (optie zwakstroom)

Werkervaring:

2008 – heden	Universitair docent Katholieke Universiteit Leuven
2005 – heden	Docent electronica-ICT aan Katholieke Hogescholen Kempen en Limburg
2003 – 2005	Postdoctoraal onderzoeker Department of Electrical Engineering (ESAT) KU Leuven
2001 – 2003	Postdoctoraal onderzoeker Department of Electrical and Computer Engineering aan University of Canterbury (Nieuw-Zeeland)
1996 – 2001	Wetenschappelijk medewerker Medical Imaging and Signal Processing Group – Department of Electronics and Information Systems – Universiteit Gent

Overig:
Lid van de facultaire doctoraatscommissie.
Lid van de Industrieel Onderzoekfonds(IOF) Raad KU Leuven
Senior lid IEEE (Institute of Electrical and Electronics Engineers)
Lid ISBEM (International Society for Bioelectromagnetism)
Lid Belgian Society for Medical and Biological Engineering and Computing

Publicaties (2011 en 2012, meer op aanvraag):
IT (Articles in internationally reviewed academic journals)
- Mijovic, B., Vanderperren, K., Novitskiy, N., Vanrumste, B., Stiers, P., Van den Bergh, B., Lagae, L., Wagemans, J., Sunaert, S., Van Huffel, S., De Vos, M. (2012). The “Why” and “How” of JointICA: Results from a visual detection task. *NeuroImage, 60*(2), 1171-1185 (IF most recent : 5.94).
- Novitskiy, N., Ramautar, J., Vanderperren, K., De Vos, M., Mennes, M., Mijovic, B., Vanrumste, B., Stiers, P., Van den Bergh, B., Lagae, L., Sunaert, S., Van Huffel, S., Wagemans, J. (2011). The BOLD correlates of the visual P1 and N1 in single-trial analysis of simultaneous EEG-fMRI recordings during a spatial detection task. *NeuroImage, 54*(2), 824-835 (citations : 2) (IF most recent : 5.94).

IC (Papers at international scientific conferences and symposia, published in full in proceedings)
- Debard, G., Karsmakers, P., Deschodt, M., Vlaeyen, E., Van den Bergh, J., Dejaeger, E., Milisen, K., Goedemé, T., Tuytelaars, T., Vanrumste, B. (2011). Camera Based Fall Detection Using Multiple Features Validated with Real Life Video. In : Workshop Proceedings of the 7th International Conference on Intelligent Environments, 10. International Conference on Intelligent Environments - IE 2011. Nottingham, UK, 25-28 July 2011 (pp. 441-450). Amsterdam: IOS Press.

- Van Looy, W., Cuppens, K., Bonroy, B., Van de Vel, A., Ceulemans, B., Lagae, L., Van Huffel, S., Vanrumste, B. (2011). Detection of body movement using optical flow and clustering. In : Proc. of the 2nd International Conference on Positioning and Context-Awaerenss, accepted. PoCA 2011. Brussels, Belgium, Mar. 2011.

IMa (Meeting abstracts, presented at international scientific conferences and symposia, published or not published in proceedings or journals)

- Van Den Broeck, B., Karsmakers, P., Demuynck, K., Van hamme, H., Vanrumste, B. (2011). Automated vocal assistant: distant microphone preprocessing, Proceedings of the Annual IEEE EMBS Benelux Symposium. annual IEEE EMBS Benelux Symposium. LEUVEN, 1-2 December 2011 (1-1).
- Mertens, M., Debard, G., Van den Bergh, J., Goedemé, T., Milisen, K., Tournoy, J., Davis, J., Croonenborghs, T., Vanrumste, B. (2011). Towards automatic monitoring of activities using contactless sensors, Proceedings of the 20th Annual Belgian Dutch Conference on Machine learning. Annual Belgian Dutch Conference on Machine learning. The Hague, Netherlands, 20 May 2011 (121-122).
- Bonroy, B., Gransier, R., Dunias, P., Meijer, K., Vanrumste, B. (2011). Ambulatory measurement of physical activity based on knee flexion/extension : Preliminary evaluation of a smart knee brace, Proc. ICAMPAM 2011. ICAMPAM 2011. Glasgow, U.K., 2011.
- Cuppens, K., Van de Vel, A., Bonroy, B., Milosevic, M., Krols, R., Gijsemans, L., Vervisch, J., Tuytelaars, T., Ceulemans, B., Lagae, L., Van Huffel, S., Vanrumste, B. (2011). Extraction of features for myoclonic shock detection in video based on mean shift clustering for constructing motion tracks, Proc. of the 9th European Paediatric neurology society congress. EPNS congress. Cavtat, Dubrovnik, Croatia, May 2011.
- Van de Vel, A., Cuppens, K., Bonroy, B., Milosevic, M., Krols, R., Gijsemans, L., Vervisch, J., Lagae, L., Van Huffel, S., Vanrumste, B., Ceulemans, B. (2011). Accelerometers for noctural motor seizure detection in pediatric patients with epilepsy, Proc. of the 9th European Paediatric neurology society congress. EPNS congress. Dubrovnik, Croatia, May 2011.
- Van de Vel, A., Cuppens, K., Bonroy, B., Milosevic, M., Krols, R., Gijsemans, L., Vervisch, J., Lagae, L., Van Huffel, S., Vanrumste, B., Ceulemans, B. (2011). Detection systems and algorithms for motor seizures in pediatric patients with epilepsy, Proc. of 29th International Epilepsy Congress. 29th International Epilepsy Congress. Rome, Italy, Sep. 2011.

AMa (Meeting abstracts, presented at other scientific conferences and symposia, published or not published in proceedings or journals)

- Cuppens, K., Van de Vel, A., Bonroy, B., Ceulemans, B., Lagae, L., Tuytelaars, T., Van Huffel, S., Vanrumste, B. (2011). Detection of myoclonic shocks in nocturnal video by means of motion tracks. IEEE/EMBS Benelux. Leuven/Brussels, 1-2 December 2011.
- Van de Vel, A., Cuppens, K., Bonroy, B., Milosevic, M., Krols, R., Gijsemans, L., Vervisch, J., Lagae, L., Van Huffel, S., Vanrumste, B., Ceulemans, B. (2011). Accelerometers for noctural motor seizure detection in pediatric patients with epilepsy. Knowledge for growth. Ghent, Belgium, May 2011.
- Cuppens, K., Lagae, L., Ceulemans, B., Van Huffel, S., Vanrumste, B. (2011). Optical flow based motion tracks for the detection of nocturnal myoclonic shocks in pediatric patients. 3rd Dutch bio-Medical Engineering Conference 2011. Egmond aan Zee, Nederland, Jan. 2011.

ER (external reports: reports by order of – or published by - an external organisation)

- Goedemé, T., Debard, G., Dejaeger, E., Deschodt, M., Milisen, K., Van den Bergh, J., Vlaeyen, E., Vanrumste, B. (2011). Eindverslag FallCam: Camerasysteem voor valdetectie bij ouderen. IWT-Tetra-project 80150.

Mevrouw ir. A. Diepeveen

Mevrouw Diepeveen is ingezet vanwege haar deskundigheid op het gebied van innovatie en watertechnologie. Mevrouw Diepeveen is directeur Innovatiebureau Watertechnologie bij Netherlands Water Partnership (NWP) in Den Haag, waar zij verantwoordelijk is voor het opzetten, coördineren en uitvoeren van netwerkactiviteiten in het kader van het Innovatieprogramma Watertechnologie. Tevens is zij directielid NWP en sectorvertegenwoordiger voor deelsector Watertechnologie binnen diverse netwerken en programma's waaronder Topsector Water. Zij is bestuurslid geweest van de beroepsvereniging KIVI NIRIA, regio Noord (Koninklijk Instituut Van Ingenieurs), een hoogwaardig technisch kennis- en kennissennetwerk. Voor deze visitatie heeft mevrouw Diepeveen onze handleiding voor panelleden ontvangen en in een voorbereidende vergadering is zij aanvullend geïnstrueerd over het proces van visitatie en accreditatie in het hoger onderwijs en over de werkwijze van NQA.

Opleiding:

2009 – 2010	MIT Sloan Fellows Program in Innovation and Global Leadership, MIT Sloan School of Management, Massachusetts Institute of Technology, Cambridge USA
1994 – 1999	Technische Bedrijfskunde, specialisatie Procestechniek, Universiteit Twente
1990 – 1994	Chemische Technologie, Hogeschool Enschede

Werkervaring:

2010 – heden	Netherlands Water Partnership, Den Haag - directeur Innovatiebureau Watertechnologie
2007 – 2009	Wetsus, Technologisch TopInstituut Watertechnologie, Leeuwarden - Scientific Project manager
1999 – 2007	BetaWater, dochtermaatschappij Waterleidingmaatschappij Drenthe - business development/accountmanager
1994 – 1999	Norit Membrane Technology, Enschede - business management assistent

Overig:

2007 – 2009	bestuurslid Kivi Niria, regio Noord

De heer A. de Vries

De heer De Vries is ingezet als studentlid. Hij volgt de hbo-bacheloropleiding Elektrotechniek bij Saxion Hogescholen. De heer De Vries is representatief voor de primaire doelgroep van de opleiding en beschikt over studentgebonden deskundigheden met betrekking tot de studielast, de onderwijsaanpak, de voorzieningen en de kwaliteitszorg bij opleidingen in het domein. Voor deze visitatie is de heer De Vries aanvullend individueel geïnstrueerd over het proces van visitatie en accreditatie in het hoger onderwijs en over de werkwijze van NQA.

Opleiding:

2008 – heden	Elektrotechniek (HBO) - Saxion Hogescholen, Enschede
2007 – 2008	Elektrotechniek (WO) - Universiteit Twente, Enschede
2001 – 2007	VWO NT met Economie – Dockinga College, Dokkum

Werkervaring:

2008 – 2009	Aerolux, Oldenzaal: Onderhouds- en plaatsingswerkzaamheden van sportveldverlichting
2002 – 2011	Diverse bijbaantjes

Overig:

2012 – 2012	3T, Enschede: Ontwikkelen van een generiek test platform in een Actel SmartFusion SoC
2011 – 2012	Saxion Hogescholen, Enschede: Ontwikkelen van een compacte capaciteitenmeter (minor)
2010 – 2011	Universiteit Twente, Enschede: Ontwikkelen van een Wishbone bus in een Xilinx FPGA (stage)

Audit Panel member NQA: Ms drs. P. Göbel

Ms Göbel is deployed as NQA auditor. Apart from more than ten years' experience with audit visits in almost all sections of *HBO* [higher professional education], her auditor qualities are based on many years of assessment experience as well as having attended auditor courses at Lloyd's Register. She has worked in higher professional education for twenty years. Ms Göbel participated in the NVAO training for certified audit secretary.

Education:

1971 – 1976	Grade two teacher training: Dutch and English:
1976 – 1979	Utrecht University, Dutch Language and Literature

Work Experience:

1980 – 1993	Lecturer of linguistic competence at *Saxion Hogeschool Enschede*:
1987 – 1995	Student counsellor at *Saxion Hogeschool Enschede*
1994 – 1997	Director at *Saxion Hogeschool Enschede*
1997 – 2000	Project leader at *Saxion Hogeschool Enschede*
2000 – 2004	Policy advisor of Quality Assurance at *HBO-raad* [Netherlands Association of Professional Universities]
at present	NQA Auditor

Annex 4: Program for the site visit

Dag 1

Tijdstip	Programmaonderdeel	Deelnemers
12.30 – 13.30	Lunch en kennismaking	De heer prof. dr. ir. G. van Straten, voorzitter De heer dr. ir. B. Vanrumste Mevrouw ir. A. Diepeveen De heer A. de Vries (student HBO Elektrotechniek Saxion) Mevrouw drs. P. Göbel (NQA-auditor)
13.30 – 18.30	13.30 uur: rondleiding 14.00 uur: materiaalbestudering - Studiemateriaal - Studentmateriaal - Alle scripties 15.00 uur: eventueel telefonisch contact met externe begeleider en alumnus 15.30 uur: paneloverleg / materiaalbestudering	Panel

Dag 2

Time	Programme topic	Participants
08.30 – 09.15	Graduation	Michiel Zeinstra (external supervisor Philips) Evert Koster (external supervisor Port of Amsterdam) Johannes Bruinsma (internal supervisor) Fenna Feenstra (internal supervisor) Esther Vertelman (internal supervisor) (she was ill during the visit) Eti de Vries (internal supervisor) Bryan Williams (internal supervisor)
09.30 – 10.15	Graduation phase	Geoffrey Olotu (graduate) Christoffer Gull (graduate) Tim Ketelaar (graduate) (he was ill during the visit) Bram Fokkens (graduate) René Nijland (student year 4) Paskal Semerdzhiev (student year 4)
10.30 – 11.15	Propaedeutic and main phase	Tim Saathoff (student year 1) Max Wessels (student year 1) Esther Tanumihardja (student year 2, direct admission) Kostadin Biserkov (student year 2) Ralf Smit (student year 2) Malte Trauernicht (student year 3) Remco Geuze (student year 3) Alexander Eick (student year 3)
11.30 – 12.15	Lecturers	Ton Bominaar (Chemistry/Interconnection secondary schools-HIT) Johannes Bruinsma (Electronics/Embedded Software/Research) Adriana Mattos Pinto (Biology/Research) Eti de Vries (Professional Skills/Honours Coordinator/Research) Bryan Williams (Mathematics/Research/CENSI coordinator) Julian Wilson (Mathematics/English/Statistics)
12.15 – 13.15	Lunch break	Panel in 3.41, staff in canteen

Time	Programme topic	Participants
13.15 – 14.00	Management	Jan-jaap Aué (dean) Joke Bruining (team leader Education) Han de Ruiter (member Executive Board) Janny Slagter (team leader Education)
14.15 – 15.00	Assurance	Jan-Wiepke Knobbe (Admission Committee/Examining Board) Esther Vertelman (Admission Committee/Graduation Committee/Curriculum Committee) Marjolein Annen (Assessment Committee/Curriculum Committee) Fenna Feenstra (Graduation Committee/Curriculum committee/ School Participation Council)
15.15 – 15.45	Extra interviews?	To be determined by the panel during the day
15.45 – 16.45	Panel	Panel
16.45 – 17.00	Management	Jan-jaap Aué (dean) Joke Bruining (team leader Education) Han de Ruiter (member Executive Board) Janny Slagter (team leader Education)
17.00 – 17.30	Closure	All, in 2.02

Gegevens gespreksdeelnemers

Studenten

NAAM	VOOROPLEIDING	STUDIEJAAR
René Nijland	HAVO	4
Paskal Semerdzhiev	Diploma High School of Food Technologies, Bulgaria	4
Alexander Eick	Zeugnis der Allgemeinen Hochschulreife, Germany	3
Remco Geuze	HAVO	3
Malte Trauernicht	Zeugnis der Allgemeinen Hochschulreife, Germany	3
Ralf Smit	HAVO	2
Kostadin Biserkov	Diploma Sofia High School of Mathematics, Bulgaria	2
Esther Tanumihardja	Surat Tanda Tamat Belajar Sekolah Menengah Umum Tingkat Atas (STTB – SMA) (Certificate of Completion of Academic Secondary School), Indonesia	2
Max Wessels	HAVO	1
Tim Saathoff	Zeugnis der Allgemeinen Hochschulreife, Germany	1

Afgestudeerden

NAAM	DATUM AFSTUDEREN
Bram Fokkens	20-07-2012
Christopher Gull	20-07-2012
Tim Ketelaar	20-07-2012
Geoffrey Olotu	20-07-2012

Externe betrokkenen

NAAM	INSTELLING	FUNCTIE
Evert Koster	Haven Amsterdam	Hoofd beleid Nautische Sector
Michiel Zeinstra	Philips	Electronic Design Engineer

Bestuurders/management

NAAM	FUNCTIE
Han de Ruiter	Lid College van Bestuur Hanzehogeschool
Jan-jaap Aué	Dean School of Engineering
Joke Bruining	Teamleider Bachelor Advanced Sensor Applications
Janny Slagter	Teamleider Bachelor Elektrotechniek en Bachelor Werktuigbouwkunde

Docenten / medewerkers

NAAM en TITEL	Studieonderdelen in jaar	Specifieke taken
Ms. M. Annen Msc	-	Assessment Committee, Curriculum Committee, Education advisor
Mr. T. Bominaar PhD	Chemistry (year 1) Professional Skills (year 1) Project supervison (year 1)	Interconnection secondary schools - ASA
Mr. J. Bruinsma Msc	Electronics (year 1, 2) Project supervision (year 3) Physics (year 2) Choosing Sensors & Electronics (year 3) Special Sensors (year 3)	Mentor, School Participation Council, Curriculum Committee, Research, Coordination Exchange students Brasil
Ms. F. Feenstra Msc	Project supervision (year 2, 3 Biology (year 2) Entrepreneurship (year 2, 3) Statistics (year 3) Operations Requirements (year 3)	Mentor, University lecturer, Graduation Committee, Curriculum Committee, School Participation Council
Ms. A. Mattos Pinto Msc	Biology (year 1, 2) Project supervision	Mentor, School Participation Council, Research
Mr. J. Knobbe PDEng	Programming Java (year 2) Sensor Networks I (year 2) Project supervision (year 2,3) Databases (year 2) Intelligent sensors (year 3) C-programming (year 3) Sensor Networks II (year 3) User Interface Development (year 3)	Mentor, Admission Committee, Examining Board
Ms. E. Vertelman PhD	Chemistry (year 1, 2) Project Supervision (year 1, 2, 3) Robotics (year 2) Research Skills (year 3) Special Sensors (year 3) Material Science (year 3)	Mentor, University lecturer, Admission Committee, Graduation Committee, Curriculum Committee
Ms. E. de Vries Msc	Professional Skills (year 1,2,3,4) Project supervision (year 1)	Mentor, University lecturer, Curriculum Committee, Graduation Committee, Honours Coordinator, Research
Mr. B. Williams PDEng	Mathematics (year 1) Simulation (year 1) Control Theory (year 2) Data Analysis (year 2) DSP Practical (year 2) Visualisation Practical (year 2) Project supervisor (year 1, 2, 3) Reliability Engineering (year 3)	Mentor, University lecturer, Examining Board, Assessment Committee, Curriculum Committee, Research (CENSI-coordinator)
Mr. J. Wilson BSc	Mathematics (year 1, 2) English (year 1) Project supervision (year 1, 2) Statistics (year 2)	Mentor, Programme Committee, Admission Committee

Annex 5: Documents examined

Lijst van meegestuurde documenten

Per post:

- Graduation Reports
- Forms Protocol course Advanced Sensor Applications
- Critical Reflection

Via de NQA portal (documenten waaraan gerefereerd wordt in de Critical Reflection):

1.1	Overview network professional field HIT, September 2012
1.2	Composition Programme Advisory Committee, September 2012
3.1	Overview lecturers ASA, September 2012
4.1	Professional profile ASA version 3.0, 30 August 2012
4.3	Profiel van de Bachelor of Engineering, March 2006
5.1	Programme Regulations ASA 2012-2013, 25 June 2012
5.2	Study guide 2012-2013, September 2012
5.3	Booklist ASA 2012-2013, July 2012
5.6	Training model ASA, October 2012
6.1	Assessment policy ASA 2012-2013, October 2012
6.2	Graduation Rules and Regulations 2011-2012, December 2011
7.1	Rapport instellingstoets kwaliteitszorg Hanzehogeschool Groningen mei 2012, *(available from website NVAO)*
7.3	Overview Graduation project reports, September 2012

Lijst van documenten ter inzage op 3 en 4 december 2012

Alle bovengenoemde documenten plus:

1.3	Statutes Hanze University, September 2012
1.4	Composition committees at HIT, April 2012
1.5	Onderwijskaders Hanzehogeschool Groningen, July 2012
2.1	Hanzehogeschool Groningen Strategisch plan: Koers op Kwaliteit, July 2009
2.2	School Strategic Plan 2010/11-2013/14, 10 July 2010
2.3	School Year plan 2012-2013 HIT, 26 June 2012
2.4	CENSI Strategic Plan 2010/11-2013/14, June 2010
2.5	CENSI Year Plan 2012-2013, March 2012
2.6	Business participation concept, 25 January 2012
3.2	Overview guest lecturers ASA, September 2012
3.3	CVs lecturers ASA
3.4	Staffing plan 2010-2014 May 2011
4.2	Report Job Market Scan on Sensorsystems And Networks, 13 September 2011
4.4	Body of knowledge and Skills ASA, October 2012
5.4	Theme study guides 4 and 8
5.5	Vaststelling Excellentieprogramma, 2010-2011, May 2012
5.7	Applied Research in the ASA Curriculum, October 2012
6.3	Guidelines digital portfolio ASA, September 2012,
7.2	Assessment audit report 2011-2012, July 2012
8.1	Application for accreditation 2008, January 2008
8.2	Memorandum on Quality assurance Hanze Institute of Technology, Sept. 2012
8.3	Examples of mid- and end-theme evaluations and corresponding improvement plans
8.4	Digital theme evaluations Overview 2011/2012
8.5	Results graduation evaluation 2012 by project supervisors, September 2012
8.6	Report NSE results HIT 2011, September 2011
8.7	Improvement plan HIT NSE 2011, February 2012
8.8	Report NSE results HIT 2012, September 2012
8.9	Report Staff Satisfaction Survey HIT 2010-2011, March 2011
8.10	Staff Satisfaction Survey reaction HIT, December 2011
8.11	Retention rate improvement plan HIT 2011-2012, December 2011
8.12	Analysis Competitors HIT, September 2012
8.13	Theme evaluations
8.14	Theme improvement plans

En:

- Studie-/studentmateriaal (boeken, toetsen, projectverslagen, etc.) van thema 4 en thema 8
- Toegang tot de elektronische leeromgeving via laptop
- Verslagen van overleg in relevante commissies en/of organen
- Digitale portfolio's via laptop
- Alle 7 afstudeerwerken, inclusief beoordelingen

Annex 6: Summary theses

Below a summary of the students whose theses have been examined by the panel. According to NVAO's rules only studentnumbers are included.

326168
325735
325960
325741
326168
327236
325740

Annex 7: Declaration of Comprehensiveness and Accuracy

Netherlands Quality Agency

NQA

Declaration of completeness and accuracy of the information

Concerning the assessment of

Study programme: Advanced Sensor Applications

Organisation: Hanze University of Applied Sciences, Groningen

Date of visit: December 4th 2012

Undersigned: Jan-Jitte Ani

representing the management of the above mentioned study programme,

in the position of: Dean School of Engineering

declares that all information on behalf of the accreditation of the above mentioned study programme is made available in completeness and accuracy, *including information on alternative graduation routes that (have) exist currently and/or during the past 6 years*, so the visitation panel can come to a properly fact-based judgment.

Signature:

Date: 8/11/2012