

# wo-master Military Technology, Processes and Systems (MTPS)

Faculty of Military Science,  
Netherlands Defence Academy

5 april 2017

NVAO extensive initial accreditation

Panel report

## Table of Contents

<b>1</b>	<b>Executive summary</b>	<b>3</b>
<b>2</b>	<b>Introduction</b>	<b>5</b>
	2.1 The procedure	5
	2.2 Panel report	6
<b>3</b>	<b>Description of the programme</b>	<b>7</b>
	3.1 Algemeen	7
	3.2 Profile of the institution	7
	3.3 Profile of the programme	7
<b>4</b>	<b>Assessment per standard</b>	<b>9</b>
	4.1 Standard 1	9
	4.2 Standard 2	11
	4.3 Standard 3	13
	4.4 Standard 4	14
	4.5 Standard 5	16
	4.6 Standard 6	18
	4.7 Standard 7	19
	4.8 Standard 8	20
	4.9 Standard 9	21
	4.10 Standard 10	22
	4.11 Standard 11	24
	4.12 Standard 12	<b>Fout! Bladwijzer niet gedefinieerd.</b>
	4.13 Conclusion	24
<b>5</b>	<b>Overview of the assessments</b>	<b>25</b>
	<b>Annex 1: Composition of the panel</b>	<b>26</b>
	<b>Annex 2: Schedule of the site visit</b>	<b>27</b>
	<b>Annex 3: Documents reviewed</b>	<b>28</b>
	<b>Annex 4: List of abbreviations</b>	<b>29</b>

## 1 Executive summary

The Accreditation Organisation of the Netherlands and Flanders (NVAO) received a request for an initial accreditation procedure, including programme documents, regarding a proposed wo-master Military Technology, Processes and Systems (MTPS) at Faculty of Military Science from the Netherlands Defence. NVAO convened an expert panel, which studied the information available and discussed the proposed programme with representatives of the institution and the programme during a site visit.

The following considerations have played an important role in the panel's assessment.

The programme is aimed at teaching students to understand, analyse, explain and improve systems and processes within a military context. The panel is impressed by the well-chosen focus of the programme. It is a useful and logical follow-up for students with a monodisciplinary technological bachelor of science or an MS&T bachelor. The intended learning outcomes are concrete and well formulated which strengthens their usefulness in the design and execution of the programme. In addition, the intended learning outcomes reflect a masters' level. Although the benchmark on the level of learning outcomes could have been stronger, the panel finds the intended learning outcomes thoroughly thought through. This includes the balance between academic and professional orientation.

The content of the curriculum is in line with the intended learning outcomes. The curriculum is balanced in terms of attention for providing students with an overview of relevant theory and challenges students to gain and use specialised knowledge to solve problems. Since research and methodology are taught 'on the fly', the panel encourages the programme to coordinate at programme level the attention given to research methodology in each course. The relation between course content and learning outcomes ensures that students are able to achieve the intended learning outcomes.

Both the structure of the programme and the teaching concept are supportive to the attainment of the learning objectives. The panel encourages the programme to continue the investment in exploring and using blended learning. The structure and teaching concept adequately tie in with the programme objectives and incoming student population.

The panel is positive about the qualifications of staff members. All staff members qualify for their tasks and the team as a whole has all the relevant expertise. The panel is additionally positive about the general educational provisions such as classrooms and the library, which are up-to-standard. The panel is very positive about the fact that students can use the UAV (Unmanned Aerial Vehicle) laboratory during their studies. The programme adequately provides students with tutoring and makes use of the small-scale environment to enhance students' participation in the academic community.

Students will be involved in the quality enhancement of the programme, the same holds for all other relevant stakeholders. The quality system adequately provides the programme with the information that is needed to evaluate individual courses as well as the programme as a whole. The panel concludes that the programmes' approach towards the assessment system is reactive instead of proactive. The programme very basically provides instruments to ensure a proper assessment of learning outcomes. To strengthen the system, the panel strongly encourages the programme to extend the exam committee with an external member and to perform its role more proactively.

In addition, it encourages the programme to establish rubrics to support this proactive role. The panel has established that minimal requirements for the assessment system are met and did not find reason to doubt the validity and transparency of assessments.

To conclude, the panel believes that the well-thought intended learning outcomes lay a solid basis for a balanced curriculum. The learning outcomes, content, structure and pedagogical principles all add to a consistent proposal for a Master programme in Military Technology, Processes and Systems. The assessment system is adequate but its proactive character must be further developed. The staff, quality assurance and other provisions create a complete environment that allows students to enjoy their study as much as possible and aim for the highest results possible.

Based on these considerations, the panel advises NVAO to take a positive decision regarding the quality of the proposed Master Programme in Military Technology, Processes and Systems of the Faculty of Military Science at the Netherlands Defence Academy.

The Hague, 5 april 2017

On behalf of the Initial Accreditation panel convened to wo-master Military Technology, Processes and Systems (MTPS) at the Faculty of Military Science of the Netherlands Defence Academy.

Prof. ir. Lou van der Sluis  
(chair)

Jetse Siebenga  
(secretary)

## 2 Introduction

### 2.1 The procedure

NVAO received a request for an initial accreditation procedure including programme documents regarding a proposed wo-master Military Technology, Processes and Systems (MTPS). The request was received on 16 August 2016 from the Faculty of Military Science of the Netherlands Defence Academy.

An initial accreditation procedure is required when a recognised institution wants to offer a programme and award a recognised bachelor's or master's degree. To a certain extent, initial accreditation demands a different approach to the accreditation procedure for programmes already being offered. Initial accreditation is in fact an *ex ante* assessment of a programme, and a programme becomes subject to the normal accreditation procedures once initial accreditation has been granted.

NVAO convened an international panel of experts. The panel consisted of:

- Prof. ir. Lou van der Sluis (*chair*), was tot 2015 hoogleraar Elektriciteitsvoorziening aan de TU Delft;
- Prof. dr. Erik Barendsen, hoogleraar Vakdidactiek Informatica aan de Open Universiteit en hoogleraar bètadidactiek aan de Radboud Universiteit Nijmegen;
- Kolonel Stafbrevethouder Rudy Vlasselaer, ir. Directeur academisch onderwijs aan de Koninklijke Militaire School in Brussel;
- Dr. ir. Koen Eneman is Campusvoorzitter van KU Leuven – Campus Groep T
- Mevr. Nienke Bach Kolling BSc, (*student*), student Master Educational Science & Technology, Universiteit Twente en Bachelor lerarenopleiding basisonderwijs, Saxion Hogeschool.

On behalf of the NVAO, Jetse Siebenga was responsible for the process-coordination and the drafting of the experts' report.

This composition reflects the expertise deemed necessary by NVAO. (Annex 1: Composition of the panel). All the panel members signed a statement of independence and confidentiality.

The panel has based its assessment on the standards and criteria described in the NVAO Initial Accreditation Framework (Stcrt. 2014, nr 36791).

The following procedure was undertaken. The panel members studied the programme documents (Annex 3: Documents reviewed) regarding the proposed programme. Their first impressions were sent to the secretary of NVAO, in order to outline these remarks within the accreditation framework and detect the items to be clarified during the site visit.

Based on its first findings, the panel organised a preparatory meeting 8 March 2017. The site visit took place on 9 March 2017 at the Netherlands Defence Academy (Annex 2: Schedule of the site visit).

The panel formulated its preliminary assessments per theme and standard immediately after the site visit. These are based on the findings of the site visit, and building on the assessment of the programme documents.

## **2.2 Panel report**

The first chapter of this report is the executive summary of the report, while the current chapter is the introduction.

The third chapter gives a description of the programme including its position within the Faculty of Military Science from the Netherlands Defence Academy and within the higher education system of the Netherlands.

The panel presents its assessments in the fourth chapter. The programme is assessed by assessing the themes and standards in the Initial Accreditation Framework. For each standard the panel presents an outline of its findings, considerations and a conclusion.

The outline of the findings are the objective facts as found by the panel in the programme documents, in the additional documents and during the site visit. The panel's considerations are the panel's subjective evaluations regarding these findings and the importance of each. The considerations presented by the panel logically lead to a concluding assessment.

The panel concludes the report with a table containing an overview of its assessments per standard.

## 3 Description of the programme

### 3.1 Algemeen

Country	: The Netherlands
Institution	: Faculteit Militaire Wetenschappen van de Nederlandse Defensie Academie
Programme	: Military Technology, Processes and Systems (MTPS)
Level	: master
Orientation	: (wo)
Specialization	: Process Track, Systems Track
Degree	: MSc.
Location	: Den Helder
Study load (EC)	: 60 EC
Field of Study	: Technical

### 3.2 Profile of the institution

The Dutch Defence Academy organises the initial officers-programmes and other programmes at the higher education level. In addition, it supports Dutch defence forces with the development of leadership and provides language training. The academy is organised in seven institutes:

- Royal Navy Institute
- Royal Military Academy
- Institute Defence Programmes
- Dutch Institute for Military History
- Faculty of Military Science
- Expert Centre of Military Leadership
- Language Centre

The academy is part of the Command Service Centre of the Dutch defence forces. It is headed by the Commander of the Defence Academy and reports to the Commander of the Command Service Centre. The Faculty of Military Sciences, as part of the Dutch Defence Academy, organises three bachelor programmes and three master programmes. Its scientific research programme aims for the improvement of military operations. The total amount of staff members is 129 FTE. The total amount of students enrolled in a bachelor or master programme is 535 in 2017.

### 3.3 Profile of the programme

The Master-programme in Military Defence Systems focuses on the military dimension of complex systems and processes with a high technical component. Students learn to understand, analyse, explain and improve systems and processes within a military context. Whereas the bachelor programmes aim to create the so-called 'thinking soldier', the Master-programme aims to transform the thinking soldier into an 'officer scholar'. The officer scholar operates effectively in military environments that are complex, knowledge intensive and stressful. In this environment the MTPS officer scholar is employed in jobs such as system or process manager, maintenance manager, weapon system manager, system integrator, data analyst or system engineer.

The need for a master programme was repeatedly expressed by senior representatives from the operational command and the Ministry of Defence. The increased complexity of weaponry and military missions as well as current developments within the Dutch national army, create the need for staff members with sufficient technical insight, who are able to oversee (arms) systems and processes. The programme is one of the instruments by which the Dutch defence forces aim to improve quality in divisions such as those that are involved in the use and maintenance of material, the purchase of new materials and the deployment of material in the context of a military mission.

The scientific disciplines that are involved in the programme are Deployment and Deployability of Military Systems, Clustering Unmanned Military Systems and Cyber Operations and Cyber Security. The programme is unique in the Netherlands because of its military focus which is not taught at other institutions. Its focus is on complex functions of material and software. Important skills in which the programme trains students are modelling and simulation. These skills support students to analyse and study both current use as well as future use of these systems in their operational environment.

The programme allows students to specialise in either the system or the process aspects of military missions, by offering two different tracks. The processes track of the programme is concerned with matters such as operations research, maintenance and logistics, of the deployability of defence systems. The systems track is mostly concerned with influencing system's performance by design changes and improved system use.

The institute organises various master programmes which are Military Strategic Studies, Strategic Border Management and the Executive Master of Security and Defence. None of these programmes display such a strong focus on technical systems and processes. The current bachelor programme 'Military Systems and Technologies' provides students with a scientific attitude and knowledge of various scientific disciplines. The master programme builds forth on it but goes a step further: it allows students to lead the development, adjustment and maintenance of military systems and processes.



## 4 Assessment per standard

This chapter presents the evaluation by the assessment panel of the standards. The panel has reproduced the criteria for each standard. For each standard the panel presents (1) a brief outline of its findings based on the programme documents and on documents provided by the institution and the site visit, (2) the considerations the panel has taken into account and (3) the conclusion of the panel.

The panel presents a conclusion for each of the standards.

### Intended learning outcomes

#### 4.1 Standard 1

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

#### *Outline of findings*

The programme started to develop the intended learning outcomes by interviewing military technical organisation managers. The response was used as a basis for the learning outcomes. The preliminary learning outcomes were then compared to international and national educational programmes and sent to independent leading experts both at international universities and national research institutes for external validation. This was the final step in the process of drafting the intended learning outcomes.

During the site visit, the panel learned that the intended learning outcomes were also shaped by various requests for assistance with solving problems that are experienced by staff members of the Dutch defence forces. The programme aims to provide students with skills that allow them to analyse and discuss these problems with specialists from various technical disciplines. Graduates will not be specialists but generalists with a technical background. They know which technical disciplines have to be involved in specific defence systems and operations *and* they know how to involve specialists with various backgrounds.

Each MTPS-graduate:

1. has insight into the most important military operational-technical developments and scientific results including its relationship with other areas;
2. has the ability to apply this insight in the military operational-technical field;
3. is able to describe and explain the complexities and possibilities of operational-technical processes and systems in a military environment;
4. is able to apply modelling, simulation and decision support techniques that are used for understanding and problem solving in the field of study;
5. is able to describe and explain the complexities and possibilities of techniques for system engineering in the field of study;
6. is able to describe and explain the complexities and possibilities of techniques for optimising maintenance and logistics of military systems;
7. is able to systematically analyse and critically assess data;
8. communicates effectively about his own academic work in both the English and Dutch language, to both professionals and non-specialists, including presentations and reports;
9. is able to work both independently and in multidisciplinary teams, interacting effectively with specialists and taking initiatives where necessary;

10. demonstrates a professional attitude towards evaluating existing knowledge, acquiring and integrating new expertise, research and towards changing circumstances with an understanding of its incompleteness, ambiguities, limitations and ethical implications;
11. is aware of the importance of life-long learning in order to maintain his recently gained professional qualifications.

In addition to qualifications 1-11 and having followed the **Processes track**, the MTPS graduate:

- 12a. has technical knowledge and capabilities that enable the graduate to build new models and to expand existing models for problem solving in operations research, logistics and maintenance;
- 13a. is able to conduct research related to military operational-technical processes;
- 14a. is able to explain the influences of changing parameters on the model outcomes in the field of study;
- 15a. is able to assume management positions related to the materiel-logistic support of military systems.

In addition to qualifications 1-11 and having followed the **Systems track**, the MTPS graduate,:

- 12b. has technical knowledge and capabilities to conduct integrated simulations of platform, sensor, weapon, C2 and communication systems;
- 13b. is able to conduct research related to the integration of military systems;
- 14b. is able to explain the influences of changing circumstances and cyber threats on the system's performance and effectiveness;
- 15b. is able to assume management positions related to technical integration for new and existing military equipment.

#### *Considerations*

The panel established that the intended learning outcomes have been developed in close collaboration with the professional field as well as with the academic community. Representatives of the professional field clearly explained how their view was incorporated in the established learning outcomes. The navy, air forces as well as the land forces have been involved in drafting the programme. This resulted in a so-called 'purple programme' that surpasses natural barriers within the defence organisation.

During the site visit, all participants expressed the necessity for generalists with sufficient capacity to analyse and manage complex processes and systems. The panel learned that the programme thought profoundly about which intended learning outcomes are necessary and which aren't. An example is provided in standard 2 (pg. 12), which discusses the considerations regarding the necessity of a more qualitative research approach. In addition, the panel finds the distinction of the two different tracks well-chosen and in accordance with the needs of the professional field.

The panel believes the master-level is well reflected in the intended learning outcomes. The panel appreciates the effort made to compare the programme to similar programmes abroad but found that the international benchmark of the programme could have been more profound. The intended learning outcomes were not involved in the comparison with other programmes. The benchmark was made at programme level. Evidence for the claim that the programme is very unique could have been stronger. The panel suggests the programme to further investigate how the programme relates to those of other military and scientific organisations. The panel especially recommends the Academy to investigate how other national defence forces solve the problems to which this programme provides an answer,

especially in context of the discussion about the eligibility of the programme for other national defence forces in the long run.

#### *Conclusion*

Overall, the panel is impressed by the well-chosen focus of the programme. It is a useful and logical follow-up for students with a monodisciplinary science bachelor or an MTPS bachelor. The intended learning outcomes are concrete and well-formulated which strengthens their usefulness in the design and execution of the programme. In addition, the intended learning outcomes reflect a masters' level. Although the benchmark on the level of learning outcomes could have been stronger, the panel believes the programme meets the standard.

#### **Curriculum**

#### **4.2 Standard 2**

*The orientation of the curriculum assures the development of skills in the field of scientific research and/or the professional practice.*

#### *Outline of findings*

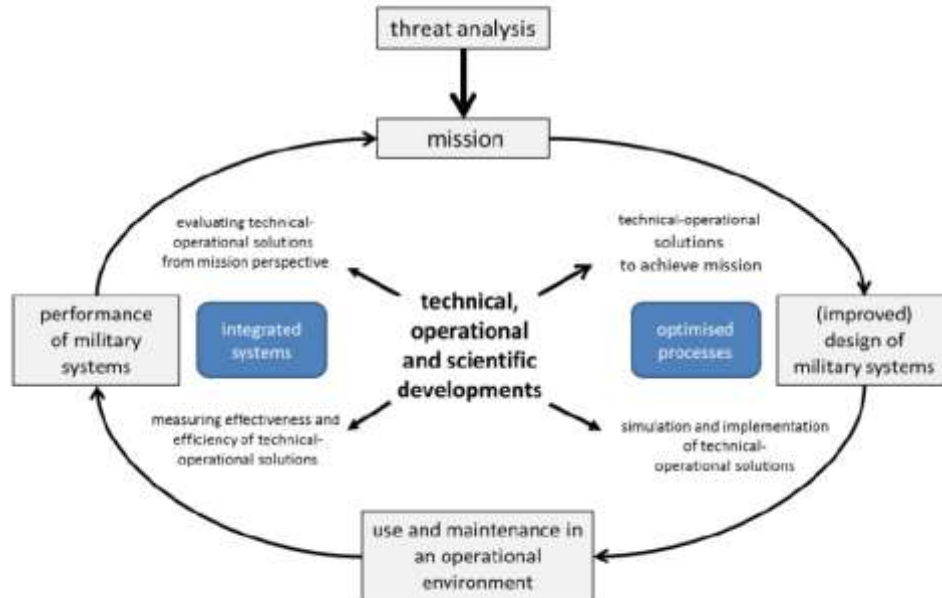
The MTPS master programme is based upon the military mission, as depicted on the next page. The figure of the mission shows how design, use and performance issues play a role during one or more missions in which the military system is deployed. The figure also shows the distinction between processes and systems, in accordance with the two tracks of the programme.

The orientation of the programme addresses various academic and professional skills. The academic skills include conducting research and communicating about it. Other skills that relate to the academic orientation of the programme are understanding (having insight), analysing, describing, explaining and having knowledge.

The skills that result from the professional orientation of the programme include the ability to apply insights, to work independently as well as in interdisciplinary teams, to take initiative and to demonstrate a professional attitude.

Since the systems and processes are operated within an organizational context, the panel wondered to what extent this context is addressed in the programme. Because graduates operate on a middle-management level, the methodological analysis of the organizational context could be beneficial to them. This would imply however, that students should also be trained in the use of social science methodologies.

From the response of the programme management, the panel learnt that the organizational context is treated as given. Although the programme acknowledged the relevance of the suggested perspective, it did not add it to the orientation of the programme, because it would make the programme too broad. The emphasis of the programme is to enhance students with the capacity to understand and analyse technical complex systems and processes. Besides, students have professional experience at middle-management level and are trained to operate within the organization.



### Considerations

The panel established that the academic orientation is very relevant to the professional field. Not only because of the level of complexity that graduates should be able to handle, but also because students need to be able to research and analyse systems and processes. In order to do so, they need to comprehend the theoretical concepts behind the systems. The panel finds the choice to not include methodology of social sciences a convincing and legitimate one. It encourages the programme to make this choice more explicit, for example in the thesis guide and other courses in which students bring in their own topics. It is important that it is clear for both students and staff what kind of problems fall within the scope of the programme and what not.

### Conclusion

The panel believes the balance between academic and professional orientation is well-thought. Therefore, the programme meets the standard.

### 4.3 Standard 3

*The contents of the curriculum enable students to achieve the intended learning outcomes.*

#### *Outline of findings*

The curriculum of the programme is described in the study guide. The curriculum consists of core courses and track-specific courses. The core curriculum consists of five courses, each worth 5 EC. The tracks each consists of three 5 EC courses. A visual representation of the curricula is depicted below:

EC	Processes track	Systems track
5	Advanced Technologies in Warfare (ATW)	
5	System Engineering Principles (SEP)	
5	Life Cycle Management (LCM)	
5	Modelling, Simulation and Data Analysis (MSDA)	
5	Command & Control (C&C)	
5	Optimal Deployment (ODT)	System Modelling and Integration (SMI)
5	Sustainment of Military Systems (SMS)	Military System Specialisation (MSS)
5	Topics in Logistics, Maintenance and Operations Research (TLMOR)	System In Context (SIC)
20	Thesis	
60		

The programme provides students with an *overview* of relevant research approaches and topics and with *specialised* knowledge. The specialised knowledge consists of highly specialised theories and is aimed at providing an example of the kind of knowledge students need to involve when solving a problem. In addition, it might challenge students to go deeper into theory that is used in the processes and systems they need to manage. The content of the programme is closely tied to the strategic agenda of the Dutch Defence. Hot topics such as cybersecurity and life-cycle management are addressed because of their relevance for the professional field. These topics might change over time and the programme will develop accordingly.

The study guide provides course descriptions. Each course description contains the course structure, teaching methods, assessment method, literature, a general course description and course objectives. A table provided in the application file shows how each course adds to the attainment of the final qualifications.

The prescribed literature consists of academic books and articles, written in English. The panel learned that the programme involves both literature that provides an overview as well as literature that goes very deep into certain complex scientific subjects.

### *Considerations*

The panel is positive about the learning objectives per course. They are concrete and specific and as such make very visible what students learn during each course. The panel recommends further specification by relating each course objective to the designated learning outcome so that it is clear to what end each learning objective is part of the course.

The panel appreciates the position of scientific literature within the courses. Literature allows students to get the overall picture on the one hand, and on the other hand, challenges students to develop their capacities in understanding the type of solutions that specialists provide to solve complex problems. This supports students in developing their profile as knowledgeable generalists or 'officer scholar'.

The panel noticed the programme does not contain a course which specifically addresses research skills. Research skills are taught 'on the fly'. During discussions with the teachers, the panel noticed that all teachers address research skills as well as methodological issues. The panel believes the programme could be even stronger if it more clearly specifies and coordinates the attention that is given to research and methodology for the programme as a whole.

The panel is positive about the balance between content that provides students with an overview and content that is more specialised. This will provide students with the needed ability to methodologically solve problems in their professional environment and involve all relevant stakeholders. In addition the panel is positive about the change that might occur in 'hot topics'. The amount of attention which is reserved for hot topics is not too much but sufficiently substantial to make a difference to what students know when they graduate from the programme.

### *Conclusion*

The panel has established that the content of the curriculum is in line with the intended learning outcomes. The content is balanced in terms of attention for providing students with an overview of relevant theory and challenge students to gain and use specialised knowledge to solve problems.

Since research and methodology are taught 'on the fly', the panel encourages the programme to coordinate at programme level the attention given to research and methodology in each course. The relation between course content and learning outcomes ensures that students are able to achieve the intended learning outcomes. The panel suggests to clearly relate the course learning objectives to the learning outcomes. Overall, the panel is very positive about the content of the curriculum. Therefore, the programme meets the standard.

## **4.4 Standard 4**

*The structure of the curriculum encourages study and enables students to achieve the intended learning outcomes.*

### *Outline of findings*

The programme comprises one day per week for face-to-face teaching and learning during the first 1,5 year of the programme (63 weeks – i.e. 42 weeks per year). The programme reserved Fridays for these face-to-face gatherings.

Students are expected to study additionally 12 hours per week. The last half year of the programme is dedicated to the writing of the thesis. The Academy learned from other part-time master programmes that regular comeback meetings help students to make progress in their thesis period.

To ensure the employers' support for this construction, all students who are employed by the military must submit a request form and receive written permission both from their military operational command and from their commanding officer or director. The panel discussed how the programme deals with students that have to take part in military missions during their studies. The programme management as well as representatives from the professional practice replied that as a principle, students will not be sent abroad. If a student as an exception does need to take part in a military mission, the programme will help students to continue their studies as soon as the mission is over. The academy is experienced in dealing with these dynamics in other programmes as well.

The programme is structured by two principles. In the first place, students specialize as they go through the programme. They start with general courses and then follow the courses that belong to the track they choose. Towards the end of the programme, students are invited to bring their own problem into the programme and discuss cases they work on in their professional practice. The solution to these problems often brings the need for more specialised, disciplinary knowledge. Students will be challenged to deepen their understanding in the areas that are relevant to their working environment. Lecturers will assist students by providing adequate literature and further guidance.

A second principle which structures the programme is that courses are developed at different levels, either 400, 500 or 600 level. The higher the level, the more complex the course. The programme increases in complexity. The panel noticed that staff members are used to work with this distinction and develop courses accordingly. As an illustration, they explained that in level 400-courses students will receive more guidance in studying literature and difficult papers, whereas in higher levels they are expected to study more independently.

The MTPS teaching concept leans on the preparation-feedback model in which students are encouraged to prepare well for the weekly classes. Knowledge development is stimulated by active learning in small groups. The majority of the courses require students to submit assignments spread across the teaching period and avoid coinciding deadlines. The small scale of the programme and campus (no more than 30 students per year) allows low-key organisation of activities and eases students' participation in the academic community.

The programme supports students by using 'Moodle' as an electronic learning environment. Study guides are placed on 'Moodle', as well as links to scientific literature. During the site visit, the programme elaborated upon its ambition to develop more expertise in the use of online courses. The Academy is currently exploring the development and use of online courses at other Dutch Universities. The programme intends to recommend specific, existing online courses to students who enrolled to the programme and want to prepare themselves for studying again, after not having studied for several years.

Students with dyslexia, a disability or a disease are informed about provisions during the information seminar in March. The Teaching and Examination Regulations describe the process to obtain adaptations and the responsibilities for the implementation thereof.

### *Considerations*

The panel is very positive about the structure of the programme. It is consistent with and supportive to the realisation of the intended learning outcomes. In the first place the development from a more general perspective to a more specialised approach at the end of the programme, allows students to develop a broad perspective and gain in-depth topic-specific knowledge. Secondly, it also ensures that the problems students bring in from their professional practice do not play a prominent role from the start of the programme, and protects the academic orientation from being distorted by problems students need to solve in their working environment. Thirdly, the panel noticed that the increased complexity of the programme, as marked by the different levels, is well-thought and supports the attainment of intended learning outcomes by students.

The panel established that the teaching concept was not described in-depth in the critical self-reflection. However, during the site visit, the teaching concept became much more alive. Management as well as teaching staff consistently illustrated the preparation- feedback model. The panel established that this model has been supportive in design of the programme and will be useful in the execution of the programme. With regard to blended learning as a teaching concept, the panel believes the programme is still in an exploratory phase. The panel is positive about the use of Moodle and the programme has made serious efforts to explore the benefits and possibilities of blended learning for its teaching concept. The panel encourages the programme to further invest in the development and use of blended learning so that it will actually strengthen its teaching concept.

The programme is tailored towards the circumstances of the students. The panel is positive about the fact that the Faculty used its experience from other programmes to develop this programme and will organise comeback days during the thesis period.

### *Conclusion*

The panel believes the structure of the programme as well as the teaching concept is supportive to the attainment of the learning objectives. The panel encourages the programme to continue the investment in exploring and using blended learning. It does feel however that the development thereof is not sufficient to state that blended learning is part of the teaching concept. Overall, the structure and teaching concept adequately tie in with the programme objectives and student population. Therefore, the panel concludes that the programme meets the standard.

## **4.5 Standard 5**

<i>The curriculum ties in with the qualifications of the incoming students.</i>
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### *Outline of findings*

The programme will at the start in 2017 be only accessible for students who are defence personnel and have successfully completed the bachelor of Military Systems and Technology or another academic bachelor of science. These students must have post-graduate professional experience of at least two jobs, have permission both from their military operational command and from their commanding officer or director, and be in



active service. During the site visit, the panel learned that the prospective student is not a typical specialist who completed a mono-disciplinary master. The programme is designed for students who function at a bachelor level and have relevant work experience. All students who enter the programme need to have knowledge in differential and integral calculus and complex numbers, Matrices, characteristic vectors and value, statistics, Fourier and Laplace transform, spectral analyses and need to have basic programming skills (preferably in MATLAB).

From 2019 onwards, the programme plans to allow external students. The entry requirements for these students are laid out in the teaching and exam regulation. Students have to be graduates from a technical bachelor programme, either academic or from a university of applied science and possess the knowledge described above.

The programme intends to support incoming students with deficient knowledge by offering a preparation programme (in Dutch schakelprogramma). Since the programme will only be open for students with a different background from 2019 onwards, this programme has not been developed yet. It will partly make use of courses that are offered in the Bachelor MTPS programme.

In addition to the preparation programme, the programme management foresees that students who have not been studying for some years might need to refresh their knowledge as well as academic mind-set. The programme intends to select existing online courses on math and programming which prospective students can use in order to prepare themselves. The teaching and Exam Regulations specify that the Executive Board decides about the admission, based on the advice of the exam committee. This also applies for students who completed another bachelor programme offered by the institution. All students must have sufficient command of English, at least at level C1.

#### *Considerations*

The panel appreciates the choice of the programme to start the programme exclusively for defence personnel. It provides a good starting point for the programme and students that enter the programme have a clear profile. The profile of students that are allowed to enter the programme from 2019 onwards was less clearly defined. The specific kind of job experience students need to have remains somewhat unclear. Since this is only relevant from 2019 onwards, the panel does not consider this to be a major error in the programme.

The panel is positive about the prerequisite knowledge that students need to possess before starting the programme. It is specific and also helps to manage students' expectations. The panel encourages the programme to connect this to the various courses so that it becomes clear what is the prerequisite knowledge per course.

The panel is positive about the intention of the programme to offer a preparation programme, which tailors the needs of both students with a bachelor from a university of applied science and students with a bachelor from an academic university who lack knowledge in a certain area. That the programme in addition intends to prepare prospective students with online courses is praiseworthy. The panel thinks it can be very helpful for prospective students to get acquainted again with a scientific approach, especially since academic literature has such a central place in the curriculum.

### *Conclusion*

The programme thought about the different kinds of students it will attract and adequately defined the prerequisite knowledge. The programme should more clearly define the entering requirements for the broader group of students it welcomes from 2019 onwards. Overall, the panel is positive about how the curriculum ties in with the qualifications of incoming students. The programme therefore meets the standard.

### **Staff**

#### **4.6 Standard 6**

*The staff is qualified and sufficient in size for the realisation of the curriculum in terms of content, educational expertise and organisation.*

### *Outline of findings*

The MTPS teaching staff are active researchers, as demonstrated by their PhD degrees and publications in their field of sciences. Two members of the staff do not have a PhD degree. One of them is currently finishing his PhD project and the other is a professional who is temporarily employed by the academy.

As an average, the teaching staff is expected to spend roughly 30% of their time to research, 60% to education and 10% to administration. Almost 100% of the staff is involved in one or more research programmes. These research programmes are mostly related to three specific areas of research, which are Sensor and Weapon Systems, Command and Control Systems and Operational Deployment and Deployability.

FMS NLDA has received 3 additional FTEs teaching/research staff and 1 FTE support staff to develop, carry out, evaluate and update the MTPS. This is considered sufficient for the full support and course delivery for a complete class of 30 students, starting in summer 2017. In case of personnel shortfalls and depending on the course subject, the technical bachelor programme (MS&T) capacity is available on-site and support agreements are in place with both TU Delft and University of Twente. The intended staff-student ratio is 1:10. All teachers obtained their teaching qualifications. In the past, the NLDA organised the teacher training in cooperation with other universities but since 2014, the basic teacher qualification training is organized by the NLDA itself, for which it received permission from the VSNU. Course evaluations include teacher evaluations which are addressed and discussed during staff performance evaluation.

The academy ensures that teachers are proficient in English. They need to be proficient at level C1 of the common European framework.

### *Considerations*

The panel is positive about the experience of staff members. The team as a whole covers all relevant research areas. The panel is positive about the choice the programme made to expand the team with lecturers on relevant themes, such as cybersecurity. The panel is very positive about the number of staff members that is reserved for the programme. Since the programme limits the intake of students to thirty per year, the panel is assured that the number of staff is sufficient for the coming years. The panel met an enthusiastic team of teaching staff with the relevant skills and knowledge to execute the programme. The panel

is also positive about the fact that staff members who are eligible and do not have a PhD-degree yet, are working on their PhD. The policies with regard to enhance the educational performance of staff members are up to standard.

#### *Conclusion*

The panel is positive about the qualifications of staff members. All staff members qualify for their tasks and the team as a whole has all the relevant expertise. The programme meets the standard.

### **Services and facilities**

#### **4.7 Standard 7**

*The accommodation and the facilities (infrastructure) are sufficient for the realisation of the curriculum.*

#### *Outline of findings*

The programme is located on the grounds of the Royal Netherlands Naval Institute (KIM) in Den Helder. The panel had a guided tour through the main building and training location which included the lecture hall, several classrooms, the library and a laboratory. The classrooms are equipped with all necessary amenities available. All locations achieved a WiFi network. The lecture hall has room for 260 people and provides the possibility for video conferences, lectures and readings on distance. The library contains a wide collection of military-scientific literature, both written and digital. Students and staff have access to over 25,000 e-journals in various databases.

The panel visited a UAV-laboratory which allows students to simulate and model the navigation of unmanned aerial vehicles.

#### *Considerations*

The programme is embedded in an environment that combines military history and advanced technical and scientific services. This is of clear added value given the specific military-scientific nature of the training. The classrooms, library and other facilities provide the right environment for students to study. The panel was very positive about the UAV lab, which is of very practical use to the future students of the MTPS programme.

#### *Conclusion*

The panel is positive about the provisions. General educational provisions such as classrooms are up-to-standard. The panel is positive about the fact that students can use the UAV laboratory during their studies. The panel concludes that the programme meets the standard.

#### 4.8 Standard 8

*Tutoring and student information provision bolster students' progress and tie in with the needs of students.*

##### *Outline of findings*

The programme provides tutoring by offering students a mentor. Mentors are members of the MTPS teaching staff and can be chosen by the students during their enrolment. Mentors offer study guidance, counselling and study advice (work- family- study balance). No mentor will have over 8 students. The programme recently appointed a study advisor for the Academy as a whole, who provides guidance to students who experience difficulties during their studies. For additional support, remedial and extra-curricular training, the NLDA Section Education offers help and may, at faculty costs, transfer students to external professionals.

The programme aims to establish a learning community in which students can easily contact each other as well as teaching staff. The small size of the Faculty and the structure of the programme make it easy to organize events that stimulate and encourage students to pursue the best possible results during their studies. The online learning environment helps students to communicate with their fellow students and teachers during the week. The programme starts preparing students for their studies during the information seminar in March, which is aimed at creating the necessary mindset for successful and timely completion of the programme. The introduction day at the start of the programme serves the same purpose.

Students make use of the study guide in which all relevant information about the programme can be found. The study guide contains course descriptions as well as the programme. The study guide is also provided on the online learning environment.

##### *Considerations*

The panel is positive about the tutoring system. The programme intends to follow students closely and give them timely support when they experience difficulties. The panel is positive about the appointment of a study counsellor at the level of the academy. Since this person has a larger distance towards the programme than the mentor, he can adopt a different and more independent point of view which can be beneficial for the programme and students alike.

The panel advises the programme to make more explicit the different roles that the mentor and the student counsellor have and to communicate this clearly to the students involved. The information provision is adequate and addresses all relevant issues.

##### *Conclusion*

The programme meets the standard. The programme makes use of the small-scale environment and adequately provides students with the necessary tutoring.

## Quality assurance

### 4.9 Standard 9

*The programme is evaluated on a regular basis, partly on the basis of assessable targets.*

#### *Outline of findings*

Evaluation is central to monitoring and enhancing the quality of the programme. This quality concerns the content, delivery, results, facilities and organization of the education provided. The educational quality manual describes how each component is monitored.

The course evaluation include the applied teaching methods, pedagogical skills of a lecturer, teaching materials, assessment, learning effects and course results (pass rate & objectives). Course evaluations are scheduled every two years. Courses lectured by new staff members and courses that receive a lot of negative feedback, will always be evaluated in the next period. Since the programme is new, the programme management intends to closely monitor the quality of each individual course, but also of the programme as a whole. Outcomes of the evaluation are summarized and displayed in the online learning environment.

The student satisfaction surveys evaluate the programme regarding the qualifications of the incoming students, academic progress, study load, educational programming, level and coherence of the programme, facilities, support, guidance and organisation. Alumni surveys aim at relations with the needs of the professional field, course and programme objectives, the level of graduates in general and the interaction with research.

The professional field is represented in the NLDA council ("NLDA raad"). Day-to-day input, connections at course level and research contributions are ensured by the military personnel in the MTPS department, the project office Research and Development at NLDA staff, attending and organising seminars and by the large networks of MTPS staff.

The overall programme responsibility rests with the Executive Board of the institution ("SWOON"). The primary responsibility for the evaluation plan and evaluations rests with the Programme Board. The Programme Committee monitors the quality and sends their findings and/or anomalies to the Programme Board. The Programme Board assesses all evaluations and reports to the Faculty Board.

#### *Considerations*

The panel has reviewed the evaluation system of the programme. The system is applied in other programmes. The panel has established that all relevant stakeholders are involved in the evaluation of the programme. The student surveys are very complete and cover all relevant topics. They provide the programme with a fine instrument which regularly monitors the quality of the courses. The panel is confident that the programme will also thoroughly monitor the quality of the programme as a whole. The quality manual foresees in adequate procedures and provides concrete instructions to this end.

Although the number of students is small, the panel suggests that the programme could define more assessable targets. These targets can help the programme to state its ambition with regard to the quality of the programme.

The panel is positive about the display of a summary of the outcomes of the student surveys. That the course evaluations are used as input to the performance appraisal of teachers by the institutes' management is praiseworthy. It leads to adequate assistance of teachers that want to improve their performance.

#### *Conclusion*

The panel is positive about the approach of the programme towards quality management. The quality system adequately provides the programme with the information that is needed to evaluate individual courses as well as the programme as a whole. Therefore, the programme meets the standard.

### **Assessment**

#### **4.10 Standard 10**

*The programme has an adequate assessment system in place.*

#### *Outline of findings*

The programme has defined examination policies. These are in line with the policies used by the faculty as a whole as described in the education quality manual. The programme-specific rules and regulations are laid out in the Teaching and Examination Regulations. With regard to the thesis, the programme defined principles that guide supervisors in performing their role as supervisor. These include the embeddedness of students' work in the research in which the supervisor is involved, the explanation of assessment criteria, the importance of the initial draft of the thesis as a moment in which guidance is essential to steer students in the right direction and last but not least to assist students in reflecting on their personal development and learning objectives.

The panel learnt during the site visit that the programme follows various principles with regard to examination. Not only is every course taught by several teachers, who discuss exam questions together but also a yearly review session is planned during which the team as a whole discusses a sample of the exams. During this session, the team as a whole also discusses the theses and calibrates its markings.

The thesis assessment form lists ten criteria. Students can score either insufficient, sufficient, good or excellent on each criteria. The criteria are explained in the thesis guide, which also provides a method for calculating the thesis grade. The assessment forms for other courses were not available yet but the panel reviewed assessment forms from the bachelor programme in order to review regular assessment practices. The assessment in the bachelor programme is based on rubrics which define the level at which each learning outcome is assessed.

The examination committee consists of three members. There is a vacancy for an external member. The panel learnt that the examination committee follows a yearly schedule of five meetings during which it will discuss the exams that were made in the past period. One of the meetings will be the meeting for all staff members, as described above.

Most courses are examined by papers or other assignments. Only two courses have a classical written exam. This prevents students from being pressured by having all exams in one week. It helps students to continue their involvement with their studies throughout the two-year period.

#### *Considerations*

The panel has reviewed the assessment system and encourages the programme to improve a number of elements. First of all, the programme needs to add an external member to the exam committee. The intention to add this member was not mentioned in the application file, which is the reason the panel wants to emphasize the importance of it again. Secondly, the panel noted that the exam committee has a somewhat reactive approach. It does for example not intend to review the assessment of courses before the execution of the programme. The panel believes that reviewing exams after the execution of a course, as is current practice in the bachelor programme, not only takes a lot of energy but also does not effectively and timely improve the programme. The panel strongly suggests the programme to develop rubrics for the assessment of the thesis. With regard to the assessment of the courses, the panel recommends the programme to add space for clarifying remarks.

The panel was positive about practices that seem to run through the veins of the staff members. These include the application of the four-eye principle in establishing exams and in reviewing the theses. In addition, the panel is very positive about the variety of assessment methods that is used by the programme. The panel had no reason to doubt the validity and transparency of assessment of students.

#### *Conclusion*

The panel concludes that the programmes' approach towards the assessment system is reactive. The programme very basically provides instruments to ensure a proper assessment of learning outcomes. To strengthen the system, the panel strongly encourages the programme to extend the exam committee with an external member and to perform its role more proactively. In addition, it encourages the programme to establish rubrics to support this proactive role. The panel has established that minimal requirements for the assessment system are met and did not found reason to doubt the validity and transparency of assessments.

## **Graduation guarantee and financial provisions**

### **4.11 Standard 11**

*The institution guarantees students that they can complete the entire curriculum and makes sufficient financial provisions available.*

#### *Outline of findings*

The Executive Board guarantees students that they can complete the entire curriculum. Regarding provisions, MTPS did not need significant investments since the infrastructure is already available. The yearly allocated financial resources are adequate. FMS NLDA is therefore confident that all conditions will be met well before the start of the first cohort in September 2017.

#### *Considerations*

The panel has established that the programme ensures students that they can complete the entire curriculum.

#### *Conclusion*

Meets the standard.

### **4.12 Conclusion**

The quality of the programme is assessed as positive. There is a clear vision which lays the basis for a well-thought programme. The learning outcomes, content, structure and pedagogical principles all add to a consistent proposal for this programme and tie in with qualifications of incoming students. The assessment system is adequate but its proactive character must be further developed.

### **4.13 Recommendations**

1. The panel encourages the programme to make more explicit the choice to not include methodology of social sciences a convincing and legitimate one.
2. Since research and methodology are taught 'on the fly', the panel encourages the programme to coordinate at programme level the attention given to research and methodology in each course.
3. The panel encourages the programme to continue the investment in exploring and using blended learning.
4. The panel advises the programme to make more explicit the different roles that the mentor and the student counsellor have and to communicate this clearly to the students involved.
5. The panel strongly encourages the programme to extend the exam committee with an external member.
6. The panel encourages the exam committee to perform its role more proactively. In addition, it encourages the programme to establish rubrics to support this proactive role.



## 5 Overview of the assessments

Standard	Assessment
1. <i>The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements</i>	Meets the standard (weighted and substantiated).
2. <i>The orientation of the curriculum assures the development of skills in the field of scientific research and/or the professional practice.</i>	Meets the standard (weighted and substantiated).
3. <i>The contents of the curriculum enable students to achieve the intended learning outcomes.</i>	Meets the standard (weighted and substantiated).
4. <i>The structure of the curriculum encourages study and enables students to achieve the intended learning outcomes.</i>	Meets the standard (weighted and substantiated).
5. <i>The curriculum ties in with the qualifications of the incoming students.</i>	Meets the standard (weighted and substantiated).
6. <i>The staff is qualified and the size of the staff is sufficient for the realisation of the curriculum in terms of content, educational expertise and organisation.</i>	Meets the standard (weighted and substantiated).
7. <i>The accommodation and the facilities are sufficient for the realisation of the curriculum.</i>	Meets the standard (weighted and substantiated).
8. <i>Tutoring and student information provision bolster students' progress and tie in with the needs of students.</i>	Meets the standard (weighted and substantiated).
9. <i>The programme is evaluated on a regular basis, partly on the basis of assessable targets.</i>	Meets the standard (weighted and substantiated).
10. <i>The programme has an adequate assessment system in place.</i>	Partially meets the standard (weighted and substantiated).
11. <i>The institution guarantees students that they can complete the entire curriculum and makes sufficient financial provisions available.</i>	Meets the standard (weighted and substantiated).
<b>Conclusion</b>	Positive

## Annex 1: Composition of the panel

- Prof. ir. Lou van der Sluis (*voorzitter*), was tot 2015 hoogleraar Elektriciteitsvoorziening aan de TU Delft;
- Prof. dr. Erik Barendsen, hoogleraar Vakdidactiek Informatica aan de Open Universiteit en hoogleraar bètadidactiek aan de Radboud Universiteit Nijmegen;
- Kolonel Stafbrevethouder Rudy Vlasselaer, ir. Directeur academisch onderwijs aan de Koninklijke Militaire School in Brussel;
- Dr. ir. Koen Eneman is campusvoorzitter van KU Leuven – Campus Groep T
- Mevr. Nienke Bach Kolling BSc, (*student-lid*), student Master Educational Science & Technology, Universiteit Twente en Bachelor lerarenopleiding basisonderwijs, Saxion Hogeschool.

Secretary and process coordinator.

Jetse Siebenga assisted the panel by coordinating the site visit and drafting the report.

## Annex 2: Schedule of the site visit

The panel undertook a site visit on the 9<sup>th</sup> of March as part of the external assessment procedure regarding the wo-master Military Technology, Processes and Systems (MTPS) at the Faculty of Military Science from the Netherlands Defence Academy.

Tijd	Activiteit	Vertegenwoordigers
08.45 – 09.15	Gesprek met vertegenwoordigers instellingsbestuur en onderwijsinstituut	GENM N.Geerts (Commandant NLDA) Prof. dr. Ir. P.J. Oonincx (Decaan) Prof. Dr. M.T.I.B. Bollen (portefeuillehouder onderwijs) LGEN b.d. D. Starink (Voorzitter bestuur SWOON)
09.15 – 09.30	Pauze	
09.30 – 10.30	Gesprek met vertegenwoordigers opleidingsmanagement	Prof. dr. Ir. P.J. Oonincx (Decaan) Dr. H. Nikookar (lid opleidingsbestuur) KLTZ (TD) ir Toine Vergroesen (lid opleidingsbestuur)
10.30 – 10.45	Pauze	
10.45 – 11.30	Gesprek met vertegenwoordigers werkveld	Kol. Ir . A. van Nispen (Hoofd sectie fixed Wing Aircraft) Kol. Ir. C.F. de Grauw (Hoofd sectie wapensystemen & LCM) KTZ (TD) ir. A.J. (Sander) van Luik (Hoofd Sectie WSM & Projectondersteuning) CDR (TD) P. (Peter) Knipping (Algemeen Directeur Maritieme Instandhouding)
11.30 – 11.45	Pauze	
11.45 – 12.15	Gesprek met EC	Prof. dr. ir. T. (Tiedo) Tinga (vz EC) Dr. ir. A.F. (Arthur) Vermeulen Dr. C. (Chris) Rijdsijk
12.15 – 13.15	Overleg visitatiecommissie	Visitatiecommissie
13.15 – 13.45	Rondleiding FMW / KIM	Bezoek aan lokalen en UAV-lab
13.45 – 14.45	Gesprek met docenten	KTZ dr. ir. F. (Fok) Bolderheij (UHD Navigatie) Dr. ir. A.M. (Axel) Homborg (UHD Instandhouding) Dr. ir. R.H.P. (René) Janssen (UHD Operations Research) Prof. dr. H. (Herman) Monsuur (HL Inzet Militaire Systemen) Dr. C. (Chris) Rijdsijk (UD Platformsystemen) Prof. dr. ir. E. (Eric) Theunissen (HL Avionica)
15.00 – 16.30	Overleg visitatiecommissie	Visitatiecommissie
16.30	Terugkoppeling	

## **Annex 3: Documents reviewed**

### *Programme documents presented by the institution*

Information File

Class 2017 year planning 2017-2019

Study Guide 2017-2018

Class 2017 year planning 2017-2019.pdf

Teaching and Examination Regulations 2017-2018

Thesis Guide 2017-2018.pdf

Brochure Military Technology Processes and Systems

### *Documents made available during the site visit*

Bestuurs-en beheersreglement Stichting wetenschappelijk onderzoek en onderwijs NLDA

Education Quality Manual

Onderwijsjaarverslag 2012 t/m 2014

Jaarverslagen 2013 t/m 2015 SWOON

Faculty of Military Sciences in perspective - Education and Research report 2012 -2014

Course Material

Assessment Forms and exams bachelor courses

## Annex 4: List of abbreviations

ba	bachelor
EC	European Credit
hbo	hoger beroepsonderwijs
ma	master
MTPS	Military Technology, processes and systems
NVAO	Nederlands-Vlaamse Accreditatieorganisatie
wo	wetenschappelijk onderwijs

The panel report has been ordered by NVAO for the initial accreditation of the programme wo-master Military Technology, Processes and Systems (MTPS) of Faculty of Military Science from the Netherlands Defence Academy.

Accreditation Organisation of the Netherlands and Flanders (NVAO)  
Parkstraat 28  
P.O Box 85498 | 2508 CD DEN HAAG  
T 31 70 312 23 00  
E [info@nvaio.net](mailto:info@nvaio.net)  
W [www.nvaio.net](http://www.nvaio.net)

Aanvraagnummer 005051