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4 Summary and conclusions

4.1 Research questions and research set-up

4.1.1 Research questions

The Scientific Research and Documentation Centre (Wetenschappelijk Onderzoek en Documentatiecentrum, WODC) has commissioned the ITS to evaluate a number of pilots for testing electronic monitoring systems (EMS). In total, ten pilot locations were involved, where equipment from three different manufacturers was used. The three main questions for the research are as follows:

1. How is EMS applied abroad and can we make use of the experiences abroad in the Netherlands?
2. To what extent is EMS suitable to monitor the leave agreements of TBS-detainees¹ and to what extent does EMS as an instrument contribute to the detection of violations of leave agreements, and following interventions?
3. To what extent is EMS as an instrument suitable to test (responsible) behaviour of juveniles during (un)supervised leave within the sector Juvenile Detention Centres? Can EMS help to start preparations for a return to society earlier?

4.1.2 Research set-up

During this research a distinction was made at all times between two evaluations:

- An evaluation with regard to the systems used: Siemens, Elmo Tech and Premier Geographix.
- An evaluation with regard to the applicability of EMS with TBS-detainees and juveniles (and it must be emphasized that the influence of EMS on recidivism was not investigated).

The following methods were used to answer the research questions:

- Interviews with parties involved in the Netherlands (research questions one and two).
- An evaluation form, distributed amongst the participating institutions for the technical evaluation (research questions one and two).
- Research amongst wearers by means of a questionnaire (research questions one and two).
- Literature studies, websearch and international contacts via e-mail with people involved with projects abroad (research question three).
- Working visits at home and abroad (all research questions).

¹ Forensic psychiatric patients can be convicted by a judge to be detained in a TBS-clinic: a prison facility where they receive forced psychological or psychiatric treatment.

4.2 Electronic monitoring systems

At the moment, three forms of electronic monitoring of offenders are applied within the Netherlands. The first and oldest is *electronic supervision*, which has been in use since 1995 for convicts during the final stage of their sentence. Electronic supervision is used for the verification of agreements and is a tool for the reintegration into society. *Electronic detention* has been used since 2003 and is a form of detention where the convict does his time at home, instead of in prison. Both electronic supervision and electronic detention are based on Radio Frequency Identification (RFID), which means it can only register the presence or absence of the wearer of an ankle band at a fixed location. The *electronic monitoring systems* that have been tested since 2005 can also determine whether a wearer is on the move, because it uses GPS-location. The Global Position System (GPS) used by EMS is based on 23 satellites. The position of an object or person equipped with a receiver can be determined based on the signals of at least three satellites. For monitoring people in a justice setting three modes can be used, which are:

- *Passive mode*: In this mode the position of the wearer is determined by means of GPS, but the data are only afterwards transmitted to the control centre over the GSM-network. The data concerning the position of the wearer are verified afterwards when the control centre or the supervising authorities demand it.
- *Active mode*: in this mode a continuous stream of data concerning the location of the wearer is provided by means of GPS. The location data are transmitted to the control centre with short intervals over the GSM-network. This way, the position of the wearer can almost be monitored in realtime.
- An intermediate form is the *semi-passive mode (hybrid)*. In this mode the position of the wearer of the device is determined constantly, but the system does not become active until the wearer leaves an area where he has to stay (inclusion) or enters an area where he may not go (exclusion). As soon as the wearer leaves or enters an area, the control centre is warned and switches to active mode.

Virtually all the systems presently used work in the same way. A person that needs to be monitored receives a GPS-unit, or a locator, which determines the location of that person. In addition, the person is equipped with an ankle band which is connected to the locator by means of a signal. The locator must remain within a certain range of the ankle band. The contact between the ankle band and the locator must prevent the wearer of the GPS-system from giving his GPS-unit to someone else. Only the system from Siemens consists of one unit, which is worn around the wrist.

Most systems additionally provide a unit for the wearer's residence. When the wearer is at home, the locator can be placed in a docking station in order to charge the battery. The registration of the presence of the wearer is taken over by the unit that has been placed inside the house. The wearer can then move around freely within the house, within a certain range around the unit.

4.3 The application of EMS abroad

In the United States EMS is presently being used extensively, particularly in Florida. In over half of the other states EMS is also being used. Most states already have a legal framework for the use of EMS. The main reasons for the application of EMS in the US are relieving the pressure on cell capacity, and cost efficiency. EMS is then used instead of a prison sentence. Offenders of non-violent crimes constitute the main target group for EMS. In addition, also offenders of violent and sex crimes are being monitored by means of EMS.

In England three pilots with EMS are currently being carried out. The main aim of EMS is a decrease in recidivism and the use of EMS is directed mainly at recidivists. In England EMS does not replace a prison sentence, but is used as an added means to prevent recidivism.

The United States and England are the only countries outside the Netherlands where EMS is used at a noteworthy scale. In the US and England EMS is mainly used as a replacement for regular prison sentences or in cases of release on parole, and not with delinquents with a psychiatric condition, as in the Netherlands.

Recently a limited pilot with justice workers was carried out in New Zealand, but the results of this pilot are not yet available. In a number of other countries EMS is being studied, but there are no concrete applications yet (Sweden, Spain). Information on the internet shows that the use of EMS has been legally regulated in Taiwan, but information concerning its application is not available.

Worldwide, the application of electronic monitoring systems based on GPS is still in its infancy. The Netherlands are at the forefront, along with the US and England. No information has been found on applications with juveniles. Reliable evaluations or scientific studies of the effects of EMS are not yet available.

4.4 Pilots in the Netherlands

In 2005, three pilots were carried out to test three different EMS-systems. The target groups that could participate in the tests were TBS-detainees, juveniles with a so-called PIJ-sentence (placement in a juvenile institution) and juveniles with OTS (placed under supervision). The execution of the pilots gained momentum in the course of 2005 as a result of incidents with TBS-detainees who had committed offences on leave. The emphasis with the application of EMS was therefore mainly on increasing the sense of security in society. The following conditions applied to participation in the pilots:

- Participation was voluntary.
- TBS-detainees and juveniles needed to have leave authorization.
- A risk assessment had to be made.
- The participant had a low risk profile.

Pilot 1: ST-EP/Siemens

In the TBS-sector the emphasis is mainly on the supervision on the leave of TBS-detainees. Within the sector juvenile institutions the emphasis is more on testing responsible behaviour of juveniles during their stay outside the institution. For this pilot an EMS-system is used which is being developed by Siemens, in collaboration with the institutions involved. The reason no existing systems are used is that these do not meet the requirements of the institutions. Particularly voice communication was missed.

In the system developed by Siemens both transmitter and receiver are located in one unit. This fairly hefty unit is worn like a kind of wrist band. Furthermore, voice communication is built into the unit.

Pilot 2: Elmo Tech

This pilot uses the system from Elmo Tech, supplied by ADT. The system from Elmo Tech consists of two parts:

- An ankle band;
- The locator (The Star-Unit).

The pilot is being carried out in De Kijvelanden. This is a private clinic the Department of Justice has commissioned to nurse and treat TBS-detainees. The practical applicability of EMS has been tested with respect to the execution of the leave policy.

Pilot 3: Premier Geographix

The third pilot uses the system from Premier Geographix. This system is similar to the system from Elmo Tech. But there is a difference. A hefty mobile phone is used for a locator. The wearer can be called on this. The phone also has an emergency button. When pressed, the mobile phone calls the gatekeeper or supervisor. This mobile phone cannot be used to call other people.

This pilot was carried out in Hoeve Boschoord. This is a research, expertise and treatment centre for mildly mentally handicapped and retarded people with serious behavioural disturbances, who may also have psychiatric conditions. Here, EMS is used to support the execution of unsupervised regional leave and to monitor unsupervised freedom within the grounds.

4.5 Conclusions

4.5.1 Bottlenecks with the execution of the pilots and the research

The research has not entirely been carried out according to the research set-up as described in the introduction. As a result, not all the research questions that were posed can be answered. This is due to the delay that arose with the testing of the equipment in two of the three pilots. Only the pilot at the TBS-clinic De Kijvelanden with equipment from Elmo Tech has been carried out according to plan.

Because of the delays in the projects a number of issues that were supposed to get attention could not be addressed. The most important of these is the close involvement of patients and juveniles with the pilots. As a result, the matter of informing the chain partners was been put on the backburner. There has only sporadically been contact with the police and the Public Prosecutor's office, but this has not led to protocols concerning the way the collaboration should be given shape, for instance in case a TBS-detainee gets away during his leave.

The ST-EP pilot encountered technical problems. The equipment for this pilot is supplied by Siemens. The equipment from Siemens differs from that from Elmo Tech and Premier Geographix in that it does not consist of two parts, a locator and an ankle band, but of one integrated unit worn around the wrist. The equipment from Elmo Tech and Premier Geographix had already been developed and had been used elsewhere, but the wrist band from Siemens was still in development. The ST-EP project was therefore emphatically a development project, in which one institution would initially work together with Siemens. After an incident with a TBS-detainee from another clinic, political pressure to develop safety measures increased. As a result, the project gained momentum and was expanded with a number of juvenile institutions and TBS-clinics. The organization of the project, however, was not geared to this. Furthermore, the project encountered several teething troubles because it was still in the developmental stage. To solve these problems, the software and hardware were adapted repeatedly. The latest versions were installed in the clinics around the middle of November.

The pilot in Hoeve Boschoord with equipment from Premier Geographix encountered technical problems as a result of which the equipment did not work as it should initially. Since the supplier of the equipment is located in England, it always took some time before the problems could be solved. Remarkably though, the equipment from Premier Geographix does work as it should in

the pilot in England. Because of the technical problems the staff of Hoeve Boschoord could only start testing the equipment in the second half of November. The accompanying evaluation forms have been filled out, but the number of evaluations is smaller than expected because less patients have used the equipment.

4.5.2 Results of the evaluation amongst staff at institutions

The table below shows the results of the technical evaluation of the three systems. The table shows the assessments made by the staff members from the institutions (in percentages) of the varying aspects of the use of the systems. The numbers in the table are based on the evaluation forms filled out by the staff members of the clinics. This means they reflect the subjective opinion of the people who have worked with the systems. Remarkably, the number of staff members who are positive about the system from Siemens is greater than that of those judging Elmo Tech positively, in spite of the technical problems with the system from Siemens. This is probably the result of the subjective expectations regarding the systems. It is possible that the expectations for Siemens were lower because the system was still being developed, while Elmo Tech's is an existing and already functioning system.

Overview of assessment by staff, in percentages

Manufacturer:	Siemens (N=32)			Elmo Tech (N=30)			Premier Geographix/Benefon (N=12)		
<i>Assessment users</i>	+	+/-	-	+	+/-	-	+	+/-	-
Reliability of location	61	10	29	11	85	4	60	40	0
Technical reliability	58	13	30	19	81	0	58	25	17
Putting equipment on wearer	47	53	0	91	9	0	92	0	8
Planning of routes in the system	59	38	3	91	9	0	67	17	17
Setting exclusion zones	47	47	6	91	9	0	55	45	0
Contact with wearer	27	33	40	0	64	36	75	25	0

4.5.3 General conclusions regarding EMS

The people involved at the various clinics initially differed in their vision on the goals for which EMS can be used. Both visions, however, have grown towards each other significantly through the practical application of EMS during the pilots:

- *Security*: in this vision electronic monitoring systems can be used to increase security in society. After all, TBS-detainees on leave can be followed by means of the GPS location data. In view of the preliminary results of the pilots this vision has however weakened considerably, as the application of EMS does not exactly offer security guarantees.
- *Treatment*: Electronic monitoring systems could be used in the treatment of TBS-detainees. Initially an important role was foreseen for EMS in the leave policy. The application of EMS could enable TBS-detainees and juveniles in a juvenile detention centre to go on (trial) leave or unsupervised leave earlier. The location data provided by EMS could then be used to verify whether the leave agreements were adhered to. Considering the shortcomings of EMS, its

application now tends to be used more as an extra means of supervision, rather than a total substitution.

Based on the data collected the following conclusions may be drawn regarding the application of EMS with TBS-detainees and juveniles in a juvenile detention centre:

1. The application of GPS to follow people is fairly new. The developments happen in remarkably quick succession: new batteries with a longer life span are brought on the market all the time, the locators are getting smaller, the reception of GPS is becoming more accurate, the software increasingly user-friendly. The results of this research are therefore only a snapshot of the current situation.
2. Outside the Netherlands EMS is only applied in the legal sphere in the US and England. In England this involves pilots of a limited duration. Only in the US has the use of EMS been legally regulated at the moment.
3. In the countries where EMS is being applied, it is used as a substitute for prison sentences, with suspended sentences or with cases of release on parole. Delinquents with a psychiatric condition are excluded from participation.
4. The location data acquired with the equipment tested have a certain margin of unreliability. The exact place a person is located cannot be determined, but it can be determined whether he has been near a certain location. The margin varies, according to information from the manufacturers, from two to five metres. A number of publications, however, also mention a margin of ten metres.
5. In order to be able to determine a location by means of GPS, the locator must receive signals from at least three satellites. It is not yet possible to determine a position via GPS:
 - In the 'shade' of tall buildings, for instance in town centres.
 - Inside buildings or underground, for instance in car parks, shopping malls or the subway.
 - In trains.
 - Under thick foliage, like in a forest.As soon as the locator receives the signals from three satellites, location becomes possible again.
6. There are a number of blind spots within the Netherlands because of beacons used by the Schiphol air traffic control and for military purposes. In the vicinity of these beacons GPS-location is not possible.
7. GPS suffers from drifting: when a person remains in the same place for some time, the location data still indicate that this person has moved. This drifting is caused by systematic deviations in the GPS-location.
8. The life span of the battery is limited and partly depends on the way the system's wearer is being monitored. In the active mode the position data of the wearer are downloaded by the central server with short intervals. Currently the battery can operate for approximately four hours in active mode. The life span increases when a less intensive mode is used, such as the hybrid or passive mode.
9. The location data acquired through GPS only provide information on the place the wearer of the equipment is located or has been located. They do not provide any information on what the wearer is doing at that time.
10. The ankle bands are made of tough materials and, like the locators, they are equipped with warning systems in case the wearer tries to sabotage the system. In spite of this it is still possible to sabotage the system, for instance by:

- a. Removing the ankle band, or in the case of Siemens: the wrist band, and throwing away the locator².
 - b. Covering the ankle band and locator, for instance with aluminium foil, making GSM-contact and GPS-location impossible.
11. The system generates a warning when sabotage takes place. But when the sabotage happens at a place or moment without GSM-contact, the warning cannot be transmitted to the control centre. The only thing known at that moment is that there is no GSM-contact.
 12. After sabotage the wearer is lost without a trace. The only things known are the location where he sabotaged his band and the places he has been before the system was sabotaged. It is however likely that some time will pass before staff from the clinic, institution or the police are on site. By that time, the wearer may have disappeared without a trace.
 13. It is questionable whether wearing an EMS-system will discourage its wearer from committing an offence.
 14. In case the wearer commits an offence while wearing the ankle band and carrying the locator, the value of the location data as evidence is dubious. The only thing that can be said for certain is that the wearer was *in the vicinity* of the crime scene. This does, however, not prove that the person has actually committed the offence.
 15. The application of EMS is only useful with TBS-detainees and juveniles in a juvenile detention centre with whom agreements can be made and who can be expected to keep these agreements.
 16. Staff members from TBS-clinics and juvenile detention centres indicated in interviews that they see a role for EMS in a support capacity when freedom is increased as the treatment progresses. EMS may serve as an extra means to verify that agreements are observed, but considering its shortcomings does not offer any security guarantees.
 17. Monitoring by means of GPS, regardless of the mode chosen, is extremely labour intensive.
 18. The costs of the various systems cannot yet be evaluated. The various suppliers were asked about the costs, but since this research involves the execution of pilots and not an actual tender, the suppliers could not make a quotation. Furthermore, the system from Siemens is still in development and the price of the final product is not yet known. The costs of the systems depend on the number of units that would have to be supplied and the service bought. In the numbers that are known regarding the costs of the system in the US and England all kinds of administrative expenses are not included.

4.5.4 The three systems used in the pilots

General remarks regarding the systems

1. First and foremost, the technology of electronic monitoring systems is far from fully developed. Changes and improvements to the technology are being made constantly: Batteries get a longer life span, the equipments is made smaller, the location gets more accurate, the software becomes more user-friendly and new possibilities for application emerge. At the moment, changes come in quick succession.
2. As a result of problems in the execution of two of the three pilots, it is at the moment hardly possible to make a meaningful comparison between the three systems used. There is insufficient comparable research material to determine which system is the most useful.

² It is possible to manufacture an ankle or wrist band with material that cannot be sabotaged by the wearer. This is, however, not allowed: for instance, in case the wearer is involved in an accident, the ankle or wrist band must be removable for the purpose of medical treatment.

3. All three systems generate warnings when the equipment is not functioning properly. This is not necessarily the result of sabotage, but warnings are also issued when the wearer no longer has contact with the GPS because he is in the subway, for instance. The warnings must therefore be handled with great care. If each warning must be followed up and has to result in the mobilization of a tracking service, the motivation with the tracking service will soon dwindle because of the number of false alarms.
4. The number of warnings generated by the system make it hard to determine in which cases there is actually cause for alarm. This diminishes response times.
5. Regardless of the system used, institutions that are going to work with EMS will have to set up extensive and meticulous protocols regarding the procedures in case of warnings from the system and violations of agreements by a wearer.

Siemens (32 tests)

6. Is a system still in development and not yet in production.
7. Consists of a single unit: locator and GSM are integrated in one device, which is worn around the wrist.
8. Offers the possibility of voice communication.
9. Does not offer the possibility of RFID.
10. Appears, after a troublesome start with many growing pains, to work in practice, with the limitations summed up in the general conclusions regarding EMS.

Elmo Tech (30 tests)

11. Is an existing system also in use elsewhere.
12. Consists of two units: a locator and an ankle band.
13. Does not offer voice communication.
14. Offers the possibility of RFID.
15. Appears, according to the evaluation forms, to work in practice, with the limitations summed up in the general conclusions regarding EMS.

Premier Geographix (12 tests)

16. Is an existing system also in use elsewhere.
17. Consists of two units: a locator and an ankle band.
18. Offers the possibility of voice communication.
19. Offers the possibility of RFID.
20. Appears, after initial technical problems, to work, with the limitations summed up in the general conclusions regarding EMS.

Summary of the assessment by staff members, in percentages, and some specifications of the systems tested

Manufacturer:	Siemens (N=32)			Elmo Tech (N=30)			Premier Geographix/ Benefon (N=12)		
<i>Assessment users</i>	+	+/-	-	+	+/-	-	+	+/-	-
Reliability of location	61	10	29	11	85	4	60	40	0
Technical reliability	58	13	30	19	81	0	58	25	17
Putting equipment on wearer	47	53	0	91	9	0	92	0	8
Planning of routes in the system	59	38	3	91	9	0	67	17	17
Setting exclusion zones	47	47	6	91	9	0	55	45	0
Contact with wearer	27	33	40	0	64	36	75	25	0
<i>System specifications</i>									
Number of units to be worn	1			2			2		
Voice communication	Yes			No			Yes		
Text messages	No			Yes			Yes		
In production	In development			Yes			Yes		
Supplier	Siemens			ADT			Premier Geographix		
Data transmission	GSM			GSM			GSM		
Possibility of presence verification when wearer is 'at home' (RFID)	No			Yes			Yes		

Sources

Literature

Black, M. and R.G. Smith, Electronic monitoring in the criminal justice system. In: *Trends and issues in crime and criminal justice*, no. 254, Australian institute of criminology, May 2003. URL: <http://www.aic.gov.au>

Fransson, A.P., *Reinforcing restraining order using electronic monitoring*. Swedish national council for crime prevention, 2005.

Frost, G.A., Florida's innovative use of GPS for community corrections. In: *Journal of offender monitoring*, vol. 15, no. 2 (autumn 2002), p. 6-10.

Gowen, D., Remote location monitoring: a supervision strategy to enhance risk control. In: *Federal probation*, vol. 65, no. 2 (2001), p. 38-41.

Hoshen, J. and G. Drake, *Offender wide area continuous electronic monitoring systems: project summary*. US Department of Justice/National Institute of Justice, 2000.

Hyde, P. and N. Dejarnatt, GPS offender tracking and the police officer. In: *Journal of law enforcement technology*, vol. 32, no. 6 (June 2005), p. 136-143.

Johnson, K., States' use of GPS offender tracking systems. In: *Journal of offender monitoring*, vol. 15, no. 2 (autumn 2002), p. 15-26.

Karuppanan, J, Mapping and corrections, management of offenders with geographic information systems. In: *Corrections Compendium*, vol. 30, no. 1 (January 2005), p. 7-9, 31-33.

Mainprize, S., Elective affinities in the engineering of social control, the evolution of electronic monitoring. In: *Electronic Journal of Sociology*, vol. 2, no. 2 (nov. 1996). www.sociology.org/content/vol002.002/mainprize.html

McGarigle, B., Satellites help track offenders in realtime. In: *Government technology*, May 1997. www.govtech.net/magazine/story.print.php?id=95330.

Mercer, R., Global positioning satellite system: tracking offenders in real time. In: *Corrections Today*, vol. 62, no. 4 (July 2000), p. 76-80.

National Law Enforcement and Corrections Technology Center, *Bulletin: keeping track of electronic monitoring*. October 1999.

National Probation Service, *Electronic Monitoring News*, Issue 1, July 2003.

National Probation Service Briefing, *Piloting of satellite tracking technology*. Issue 21, September 2004.

Nellis, M, Electronic monitoring, satellite tracking, and the new punitiveness in England and Wales. In: John Pratt, et. al. (eds.), *New Punitiveness: trend, theories, perspectives*. Devon (Willian publishing) 2005.

Nellis, M., Out of this world: the advent of the satellite tracking of offenders in England and Wales. In: *Howard journal of Criminal Justice*, vol. 44 (May 2005), p. 125-150.

Office of program policy analysis and government accountability, *Electronic monitoring should be better targeted to the most dangerous offenders*. Report no. 05-19, April 2005.

Reza, J.D., Do you know where your offenders are? In: *Law enforcement technology*, vol. 31, no. 6 (Juni 2004), p. 118-123.

Siuru, B., Tracking 'down': space-age GPS technology is here. In: *Corrections technology and management*, vol. 3, no. 5 (September 1999), p. 12-14.

Trade Union and Professional Association for Family Court and Probation Staff (NAPO), *Electronically monitored curfew orders: time for a review*. Briefing, April 2005. www.napo.org.uk

Washington Association of Sheriffs and Police Chiefs, *Monitoring sex offenders with GPS technology, report to the legislature*. WASPC (Washington Association of Sheriffs and Police Chiefs), Washington State Department of Corrections, Washington State Department of Social and Health Services, January 2004

Whitfield, D., *Tagging offenders: the role of electronic monitoring in the Scottish criminal justice system*. www.scotland.gov.uk/consultations/justice/tagging-41.pdf

Websites

www.aic.gov.au

www.bra.se

www.corrections.govt.nz

www.crimereduction.gov.uk

www.dc.state.fl.us

www.debatabase.org

www.electronic-government.co.uk.

www.fcn.state.fl.us.

www.govtech.net

www.nlectc.org

www.probation.homeoffice.gov.uk

www.renzema.net