

Water Cannon National Water Cannon Project Board – Fact finding visit to German Federal Police 3rd – 4th July 2013	Title:	
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Executive Summary

From 3-4 July 2013 members of the National Water Cannon Project Board travelled to Germany to view water cannon that the German Federal Police are offering for sale. The sale is prompted by a downsizing in their water cannon fleet. The cannon concerned were manufactured by Rosenbauer and are approximately 25 years of age. They are the Wasserwerfer 9000 model (WaWe 9) and have been in service with the German Federal Police since construction.

The WaWe 9 is a traditional water cannon which deploys a relatively simple tactic of projecting water at force into a crowd with a view to dispersing that crowd. The vehicles seen by the delegation in Germany appear to have that capability along with the necessary safety measure of being able to reduce or increase the pressure of the water projected, thereby increasing or decreasing the effective range and effect of the tactic.

The delegation had the opportunity to view all aspects of the water cannon and to consult with colleagues from the German Federal Police regarding both technical and tactical considerations. The vehicles are generally in good working order and have been well maintained. They have three monitors (two front and one rear) with the front monitors providing 360 degree coverage around the vehicle. The vehicles have a limited evidence gathering facility and have a PA system for communicating with crowds. The key issues identified are:

- Lack of diffuser mode. The WaWe 9 does however have the capability to achieve the same outcome as a diffuser mode by projecting water into the air at a low force, thereby making crowds wet and uncomfortable.
- Failure to meet emissions requirements for entry into the London Emission Zone.
- Limited evidence gathering capability.
- Lack of camera facility to facilitate aiming of the cannon (may impact on SACMILL statement).

- Risk of water tank failure. Water cannons of this age are prone to corrosion in the main water tank. Critical failure of the tank would be time consuming and costly to repair and may not be economically justifiable.
- Availability of spare parts. Whilst spares are widely available for the normal mechanical aspects of the vehicle, the spare parts for the special fittings (pumps, pipe work, body panels etc) are not widely available and have to be specially manufactured when required. Repairs are likely to be costly and time-consuming.

Whilst the above issues are not insurmountable the cannons should not be seen as a long-term solution. Solutions have been found to the majority of the above issues with predicted costs of approximately £37k. The total cost per water cannon would therefore be in the region of £70-75k.

The below report details where the German water cannons meet the operational requirement and where they fall short. Given the timescales required to adapt the cannons it could be anticipated that they would not be available for use in the UK until Autumn 2013. Following adaptation, it is suggested that they will not have the longevity to last beyond the envisaged interim requirement of approximately two years.

1. Introduction

In early 2013, the National Water Cannon Project Board identified that the procurement of a new bespoke water cannon was likely to take in excess of 18 months. The Metropolitan Police Service made clear its desire to have water cannons available before this point in time. As such, the emphasis of the project shifted towards acquiring a short to medium-term solution. In the course of investigating all available options it became apparent that the Bundespolizei (German Federal Police), having been identified as being part way through a replacement and downsizing programme for their own water cannon fleet, had five excess machines for sale.

In order to assess the viability of this option, from 3rd-4th July 2013, members of the National Water Cannon Project Board travelled to Potsdam (HQ of the German Federal Police department responsible) and Bad Driben (location where the respective water cannons are stored). <redacted>, an Assistant Commissioner in the German Federal Police is the German lead on the project and agreed to host a fact finding visit. The delegates were:

CI Richard Munns	MPS tactical lead
DC Victoria Darbo	MPS International Assistance Unit, German speaker
<redacted>	
CI Andy Milne	West Mercia Police staff officer to SRO

The aims of the visit were:

- to establish how well the German water cannon met the police Operational Requirement;
- to view the exact water cannon and conduct an initial assessment as to their condition;
- to view a demonstration of the water cannon in use;
- to assess the feasibility of maintaining these particular water cannon;
- to better understand how the pressure assessment might be carried out;
- to identify barriers that would need to be overcome should the water cannon be deemed suitable for purchase;

Feedback from the respective delegates has been collated into this overarching report for consideration by the MPS and the National Water Cannon Project Board.

A large number of photographs and video clips are available from this visit. They are purposely excluded from this report to enable ease of sharing via e mail.

2. Rosenbauer Wasserwerfer 9000

The cannon viewed by the NWCPB delegation were both Rosenbauer machines (6288/6289). This type of machine is known variously as the Wasserwerfer 9000 or the WaWe9 for short. It shall be referred to henceforth as the WaWe 9. This model of water cannon was initially designed by Rosenbauer in the late 1980's and is a purpose-built water cannon (albeit due to its nature, it also has a limited fire fighting capability). The actual machines for sale were manufactured around 1990 but have been well maintained and will undergo a complete (6 week) service prior to any delivery to the UK.



Rosenbauer Wasserwerfer 9000 (WaWe 9)

It is important to highlight that the German Federal Police are replacing their water cannon one by one with the replacement programme expected to take a number of years. As such, it is their intention that much of their WaWe 9 fleet will remain

operational for the foreseeable future (believed to be around five years). Whilst the delegation were at Bad Döben, they were able to view one such machine in the process of what might be best described as a 'mid life overhaul'. The particular machine was subject to major servicing and new bodywork / paintwork. This not only changed the appearance of the vehicle but also confirmed that cosmetic works could change the current look of the vehicle to a presentation closer to that of the wider MPS fleet.

3. Suitability of the German water cannon for use in the MPS area and the wider United Kingdom.

3.1 Tactical and technical considerations.

An assessment has been made of the German water cannon against the agreed operational and technical requirements. Key technical and tactical observations are listed below and a detailed question and answer table is also attached at Appendix A. This provides references to the technical and operational requirements where relevant.

The WaWe 9 has a 9000 litre capacity with the capability to project water at varying levels of force (up to 20 Bar pressure). The exact distance and pressures would be subject to future testing by CAST however it was clear that the cannon was effective at significant ranges (<redacted>). The WaWe 9 has two forward-facing and one rear-facing monitors (nozzles) and has the capability to deploy water at varying pressures. The controls for water pressure are set by the vehicle commander who sits in the front of the vehicle.

If both front monitors were operated at full pressure the water would be exhausted after <redacted>. This is similar to the PSNI Somati RCV9000 cannon. Due to the raised nature of its front monitors, the WaWe 9 can direct water much closer to the vehicle than the model used by PSNI.

Without conducting the planned force and pressure data capture trials of the WaWe9 it is not possible to make any definitive statement on pressure comparisons with the PSNI Somati RCV9000. The delegation was able to confirm that the output pressure of the cannon can be regulated and from the design of the pressure control apparatus CAST believes that it would be possible to adjust the output pressure to bring the WaWe9 in line with the pressures measured on the PSNI Cannon. CAST (with technical and mechanical support) will therefore be able to use the benchmark data gathered from the PSNI cannon to set the German cannon to deliver similar pressures. This could be carried out in Germany or the UK.

The forward monitors have a directional capability of <redacted> degrees on each monitor providing <redacted> degree protection for the vehicle across the two monitors. The WaWe 9 does not have a diffuser mode as seen on the PSNI cannon. The purpose of the diffuser mode is to make a crowd wet and uncomfortable by creating a fine spray of water. The WaWe 9 does have the capability to make the crowd wet and uncomfortable

and achieves this by reducing the pressure of water and spraying it up into the air causing it to fall down onto the crowd.

The directional control system for the monitors on the WaWe9 appears to be more responsive and stable than the PSNI Cannon. The monitors however have no targeting system or camera system linked to the operators and this may result in the initial targeting of a person being less accurate than the PSNI cannon. Each monitor can rotate through <redacted> at two different speeds (2 gears). The minimum engagement distances are closer at the front than the sides and rear (jets hit the ground at <redacted> respectively).

Operators must use experience and judgement as they look out of the windows of the vehicle for target acquisition. PSNI water cannon have cameras that follow monitor movement and facilitate aiming. The lack of cameras affixed to the monitors introduces the issue that these cannon are dissimilar to those used in PSNI and as such SACMILL may have a view that they are more likely to be less accurate than the PSNI cannon. It is the opinion of the delegation that the installation of cameras to the monitors would be essential should the decision be taken to purchase these cannon.

The WaWe 9 has a purpose-built system to clean windows in the event of contamination. <redacted>

The WaWe 9 German configuration has a crew of five and includes the driver, commander, loggist and two cannoneers. The WaWe 9 has an external loudspeaker communications system operated via a microphone inside the cab or operated remotely from up to 40 meters away by use of a police radio microphone. This provides an effective mechanism for communicating with crowds and informing them of intended water cannon use. The power of this system and the increased height of the vehicle make this significantly more effective than the systems used on public order protected carriers.

The WaWe 9 uses a relatively simple evidence gathering system namely a Sony camcorder type video recorder fixed to a tripod on the dashboard of the machine and linked to 4 hard drives installed in the cab. The operator / loggist is able to use this facility to record what is taking place to the front of the vehicle. An external microphone records sound outside of the vehicle and PA broadcasts are also recorded. This system is very similar to what would be achieved by using a current video evidence gatherer officer inside the machine. The system cannot record what is taking place behind the vehicle and does not provide cctv from the monitors to the inside of the vehicle.

The evidence gathering techniques available in these machines are not advanced although it is right to point out that there is a facility to gather evidence through a limited facility to record what the crew can see and hear. As such this does meet the tactical requirements at a low level. The group agree that these systems would need to be

upgraded / replaced prior to any deployment in England or Wales (see subsequent sections).

A consistent theme of the NWCPB has been that any vehicle acquired should be capable of deployment in a metropolitan area. It is recognised that the nature of London and other major cities in the UK is such that there are often narrow roads to be negotiated (unlike some other major European cities which have been constructed more recently). The WaWe 9 has a 9000 litre capability which means that the vehicle itself is large. Dimensions are available, but as an idea it might be useful to say that WaWe 9 appears slightly larger than a London fire engine, perhaps with a bulk more similar to a large refuse collection vehicle. In terms of its manoeuvrability it is accurate to say that it would ideally be smaller in size. However, it is also right to identify that London has large refuse vehicles which operate in all parts of the city.

The size of the WaWe 9 would be a limit to its tactical deployment capability however CI Munns is of the opinion that its physical size would not be prohibitive. It is also useful to point out that its large size comes with the added benefit of a larger water capacity. At the time of the visit we were unable to ascertain the 'turning circle' of the vehicle which could be used to compare it against PSNI water cannon and other similar sized vehicles in the UK. The turning circle is thought to be in the region of 18.5m.

The WaWe 9 has the ability to act as a pump unit to clear flooding, a clean water supply vehicle (once the tank has been sterilised) and has fire fighting capability including the addition of foam to the hand held hose (not the monitors). The jets from the monitors can apparently reach 40m in height.

3.2 Engineering / mechanical aspects

Chassis Nos. <redacted>

Weights. 26000 kg Gross vehicle weight

1. 7000 kg 2. 10,000 kg 3. 10,000 kg

The WaWe 9 vehicles are of a fairly basic construction, similar to an airfield crash tender, consisting of a left hand drive crew cab with a diesel V8 engine driving through a manual gearbox to both front and rear axles via a transfer box offering additional high and low ratios. The pumping equipment is housed in the rear locker driven by a transversely mounted straight 6-cylinder engine drawing its fuel from the main vehicles fuel tank, which holds circa 300 litres (80gals).

The main water tank is mounted centrally towards the rear of the vehicle encased within a soft skinned steel body constructed to form various side mounted equipment lockers. The alloy water tank is baffled and has a capacity of 9000 litres and is accessed via a top mounted man lid, unfortunately there is limited access to view the exterior or interior of this tank.

The wheel and tyre arrangements consist of quantity 10 Hutchinson run flat systems with 12.00 R20 tyres. There is an on board tyre inflation hose, although it was difficult to establish if it would achieve the 7.5 bar (109 PSI) required to fully inflate the tyres.

The vehicles have been registered circa 1988 and 1991 respectfully and appear to have been maintained and serviced to a good standard as there is no evidence of engine and transmission leaks, noises etc. Written maintenance records are still awaited. The delegation was advised that the vehicles have been serviced annually and inspected 6 monthly and would receive an additional service prior to any purchase.

The bodywork consists of a steel inner structure or framework clad with steel painted exterior panels – corrosion was evident on some of these panels although none appeared to be structural and did not compromise the integrity of the bodywork. It was not possible to evaluate further.

The windscreen is polycarbonate and needs to be protected from UV and cold when stored. In addition it can be come scratched and damaged. The replacement cost for this is estimated to be 4000 Euros with a lead time of 5 weeks.

Whilst spare parts are available for the normal mechanical aspects of the cannon (engine, suspension, drive etc) the parts availability for the special fitments (water pump, pipe work, tank, external panels) is poor or non-existent and the Germans fabricate their own new parts when they are needed. Following any major component failure it may take some time to source or modify components. An option therefore is to purchase an extra cannon to cannibalise for spares. The water tanks themselves are original and although slight leakage is apparent, this is not significant to effect its operational efficiency, however, any significant breach in the tank could be time consuming to repair and costly as access cannot be achieved via the man lid and baffle tank apertures.

The vehicles do not have any exhaust emission equipment and are classed as 'Euro 0'. The emissions regulations for the UK require that vehicles entering London are to Euro 4 standard or above. The MPS mechanical team has established that the vehicles could be upgraded to comply with Euro 4 standard (costs detailed below). Alternatively a temporary exemption could be arranged for them or daily charges could apply however this sits outside of wider MPS vehicle policy and would need further investigation.

From a mechanical perspective, Mr Oliver would support the purchase of the vehicles based on the above information and with the knowledge that the German Police are downsizing their fleet and carrying out sympathetic restorations to some of their similar condition vehicles from which they hope to achieve a further 5 years operational use. Should any purchase be approved, Mr Oliver would recommend that another visit be arranged so that the MPS maintenance and 'Equip for Service' provider can view the vehicles to understand work that will need to be carried out and to develop German contacts in order to support the vehicles within London. Estimated costs of necessary upgrades are detailed below. The costs should be taken as a worst case but because of

the age and unknown condition of the vehicle electrical system a contingency budget of 10% would be desirable.

In addition to the above challenges it is necessary to highlight that any purchase of the machines would necessitate transportation of the vehicles to the UK, MPS paintwork and livery, MPS communications 'fit out' (provision of main set), arrangements for ongoing maintenance, provision for storage of vehicles.

3.3 Estimated Costs

Item	Cost £ ex Vat (per vehicle)	Options £ ex VAT (per vehicle)
Fully covered transportation from Berlin to UK	6,300.00	
Conformance to UK legislation	4,300.00	
London Emission Zone Compliance (Euro 4 minimum)	10,000.00	
CCTV system	11,000.00	
Painting, Livery and minor vehicle modifications and tests	5,000.00	
Rubberised paint finish, livery and minor modification and tests		9,500.00
Supply, fit and commission main set radio (Motorola MTM800)	700.00	
Full vehicle service and inspection		2,000.00
Total	37,300.00	

Timescales - total time from placement of order/ contract 8 weeks.

1 week to arrange and deliver vehicle to the UK

3 weeks to complete compliance to UK and LEZ legislation

Transfer to EFS contractor

4 weeks to complete painting comms and CCTV work

3.3 Training

Colleagues in Germany feel that it is necessary to spend three weeks training staff from the MPS in using the machines. The MPS position is that they are seeking to purchase water cannon from the German Federal Police, not to use their tactics. MPS staff will however need to develop a full understanding of how to operate the cannon and this will training will need to be delivered by the German Federal Police either in Germany or the UK.

Appendix A – Tactical and Technical Considerations

Question	Response	Link to WC-TR
Are there full service and maintenance records available?	The MPS are dealing with this, but the Germans do have a full service history for the vehicles and are willing to share this.	n/a
Were there any independent (of manufacturers) tests carried out by the Germans to determine safety in use or output pressures?	Tests were carried out in 1981 on the vehicles, but this was by the Ministry of the Interior and not the police. What was actually covered in the tests is unclear and the report is unavailable.	n/a
Are spare parts readily available?	No	n/a
What needs translation into English (instructions or pressure monitoring systems etc?)	Everything, speedometer needs mph markings.	n/a
What is the effective operational travelling distance of the water cannon on 1 tank of fuel?	Estimated to be <redacted> fuel tank is a <redacted> tank. The pump engine takes fuel from the same tank and uses between <redacted> /hr and the main engine takes <redacted> hr when not driving	WC-TR-10 Meets the req
Can the spray from the monitors be adjusted to give different spray patterns (diffused, pulsed, continuous etc)?	No, the Germans have developed tactics which enable them to do pulse, spray etc by operator skill. The jet itself is continuous.	WC-TR-24 Does NOT meet Req
Can the pressures for each monitor be controlled independently?	Yes – max pressure is limited to 20bar, 16bar, 12bar, 8bar or 4bar from commanders seat, although apparently the pump could be run at 30bar. The speed of the pump engine also affects the pressure. Each cannoneer has control of the water from their monitor from 20% to 100% of commander set pressure.	WC-TR-23 Meets the req
What is the maximum pressure?	20 bar set by the commander. (system may be able to go to 30 bar)	WC-TR-23 Currently goes to 20 bar need to investigate potential to adjust
How are lower pressures obtained?	Solenoid valves on output from pump.	WC-TR-23 Meets the req
Are there outlets other than the main two monitors?	Firehouse outlet, rear monitor at ground level, high pressure water jets on windows (to clear obscurants), sprinkler system on vehicle.	N/A

How are the monitors controlled – does this still function adequately? Is there an aiming system and if so how does it work?	Controlled via joysticks, on the two vehicles examined the systems were fully functional. Note, seats rotate with monitors, all worked. There was no camera on the monitors and operators rely on skill and experience to accurately place the jets.	N/A
What are the minimum and maximum distances the water cannon is effective over?	<redacted>	WC-TR-26 Meets the req
Can the water cannon be refilled from an open water source and, if yes, does it have a filter on the inlet to prevent debris from entering the water tank?	Yes, filter attachable to hose, vehicles also have a mesh basket which can go round end of hose. Filter has approximately 5mm holes	WC-TR-31 Meets the req WC-TR-32 Meets the req
Is everything compatible (GER vs. GB) regarding filling of the WC tank with water (threads, pipe diameters etc)?	Needs to be determined. – will be checked by MPS/LFB	WC-TR-30 The WC is refillable from hydrant, however unknown if connections on current pipe work is suitable.
Is the water tank and pipe work resistant to the effects of salt water (rusting)	Water tank is alloy as is all pipe work, believed to be resistant to salt water.	WC-TR-33 Meets the req
Can additives be added to the water (eg foam, CS etc), can this be disabled/easily removed?	Yes, CS/CN already used by Germans. Foam attachment is available for hose pipe, but not monitors. CS/CN system could be easily removed	WC-TR-35 Meets the req
Does the water cannon have a public address system and if so, what is the quality (any tests assessments or standards?)	Yes, functionality demonstrated, not formally tested. Two speakers to front and two to rear. The PA can be operated remotely.	WC-TR-37 Not technically tested only functional
Does the water cannon have the ability to project pre recorded messages?	Apparently, but not tested.	WC-TR-38 Meets the req WC-TR-39 Meets the req
Does the water cannon have a audible reversing warning?	Yes, and rear camera.	WC-TR-40 Functional tested not technical
Does the water cannon have any facility to record/log actions, if yes what are these?	Not automatically, one seat is for a loggist/recorder.	WC-TR-43 Does NOT meet the Req

Does the water cannon have any CCTV capability and recording capability, if yes what is this (media type, standards, age etc.)?	It has a capability – simple sony camcorder with recording to a number of hard discs, however this system is old and unsure if it is functioning. There are no cameras on the Monitors	WC-TR-45 Does NOT meet the Req WC-TR-46 Does NOT meet the Req
Does the water cannon have a water heater to ensure the water does not freeze?	Yes (needs checking), heating is delivered by a liquid fuel jet heater, it will need further investigation as to how it operates.	WC-TR-51 tbd
Are the doors internally lockable, are there external handles?	Doors are internally lockable and they have external handles	WC-TR-51 Does NOT meet the Req
<redacted>	<redacted>	<redacted>
Are the tyre run flat?	yes	WC-TR-51 Meets the req
Is the cabin equipped with any air conditioning or air filtration system?	<redacted>	<redacted>
<redacted>	<redacted>	<redacted>
Is there a method for removing obscurants such as paint from the windows?	High pressure water jets and large wipers on front screen. Jets alone on the side screens. Do not know how effective they are.	WC-TR-62 Meets the req
What is the maximum speed of the water cannon?	Approximately 85km/hr (52mph)	WC-TR-66 Does not meet the req
How long does it take to prepare the water cannon for operational usage?	Approximately <redacted> to fill. Apart from pre vehicle checks not aware of anything else that needs to be done prior to deployment.	WC-TR-71 tbd
Do the water jets/pump run off their own power source/engine, is there a separate tank?	Yes the pump has its own engine in the rear of the vehicle. Draws fuel from the same tank as the main engine.	WC-TR-73 Part meets the req
Does the water cannon have points to enable it to be towed? If yes where are they?	Yes, front and rear	WC-TR-74 Meets the req
Does the water fill system have a one way valve to prevent water from the tank entering the water supply network?	Yes (not seen or checked)	WC-TR-77 tbd
<redacted>	<redacted>	<redacted>

Does the water cannon have any protection against public order threats, e.g. bricks, etc being thrown at the windows?	All windows are polycarbonate, lights are covered by polycarbonate panels. Front polycarbonate screen is still available as a part (£4000)	N/A
Apart from engine power, what are the differences between the 2628 and 2629 WaWe9 vehicles?	None (solenoids for control of pressure appear to be different but these could be retro fitted replacements, needs checking)	N/A
<redacted>	<redacted>	<redacted>
Is there a toilet facility on board?	No	N/A
Are there auxiliary power supplies in the cab or on the exterior – what are their outputs?	No, appears to be 24Vdc charging connection inside cab by commanders foot well. All power is 24V.	N/A
Are there mounting points on the exterior of the cannon (roof) for auxiliary equipment?	None seen	N/A
Is there a calibration regime for the pressure sensors on the Water Cannon?	No	N/A
How has the stability of the Water Cannon been tested when travelling at speed?	No evidence given but informed vehicles are more stable if you travel with 3000l of water in tank or a full tank.	WC-TR-79 Part meets the req
Is it possible to drain the water tank/pipe work manually and if so how long does it take to empty it?	Yes, unknown how long.	N/A
How is it recommended that the vehicle blind spots are controlled during operation of the vehicle?	Each cannon has the ability to rotate through 270° covering most points, plus rear monitor mounted under rear bumper. The cannons can be rotated at a slow or fast rate (2 gear settings).	N/A
What is the recommended maintenance regime of the water delivery system?	MPS to investigate	N/A
How is the tank cleaned?	Tank can be sterilised if required, no particular cleaning regime defined. It can be use for potable water.	N/A
Is there a start-up pulse on the jets?	Not tested but not obviously apparent, will need investigating	N/A
Is any of the monitor direction control system exposed?	Yes, visible on top of vehicle, but this is 4m plus high.	N/A
Is there an intercom from outside the vehicle to the cab	Yes there are external microphones, would probably need upgrading.	N/A

