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Lantern



Project options for pilot extension and national capability

REFERENCE: IDT004-118-0302-Project options national rollout

AUTHOR: [REDACTED]

VERSION NUMBER: 0.3

DATE: 21 06 2007

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Distribution List:	
<names>	
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Sign Off Authorised By:			
Name	Responsibility	Signature	Date

Issue Control:		
Version	Date	Description
0.1	07.05.07	First draft
0.2	21.06.07	Reviewed and amended by MC
0.3	22.06.07	Reviewed and amended by BT

Controlling Documentation

Source documentation used to produce this template includes:

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1. Background

The Lantern project refers to the capability of providing mobile fingerprint identification to the officer on the street.

It essentially provides the same functionality as that provided by the 'live ID' function of the custody based 'Livescan' fingerprint machine.

As yet the device does not connect to any other database other than the IDENT1 fingerprint database. Advantage has been taken of the demographics stored against the fingerprint files on IDENT1 (File name, Date of Birth, Gender), to enrich the return made to officers in addition to the CRO number.

The device uses GPRS technology to connect to IDENT1 directly using a Virtual Private Network which is encrypted to protect data integrity. Results are sent directly back to the device and its user.

At present there are 10 forces using 100 devices.

Bedfordshire, and West Midlands who were used as lead forces, along with Lancashire, West Yorkshire, North Wales, Essex, Hertfordshire, Northamptonshire, British Transport Police, and Metropolitan Police.

The devices have not been distributed equally between forces, and this has been dealt with in previous papers.

The current pilot is due to run until 12th December 2007.

The pilot is contracted to Northrop Grumman as a change control note (CCN) against the main IDENT1 contract. In that CCN an option to extend the life of the pilot for a further 12 months (subject to additional cost) has been included.

The CCN stipulates that Northrop Grumman require at least 60 days notice to implement this extension. This means the last date this can occur is the 13th October 2007.

It is important to note at this stage, that on the 12th December 2007, if no extension of the contract exists, the matchers and the connectivity to IDENT1 will be turned off, thus the police service loses what limited capability for mobile fingerprinting it already has, at that moment.

2. External Consultation

In order to solicit the views and opinions of the police service, a user conference and workshop was held on 10th May 2007, which involved the 10 pilot forces and other identified stakeholders. This conference represented roughly 20% of the total number of police forces in England, Wales and Scotland. Large metropolitan forces along with small, medium, and large county forces, all being represented.

Both users and those from a senior, strategic perspective from each of the forces and stakeholders, attended the conference and a number of workshops were held on the various options discussed in this document.

The output from that conference can be taken as being widely representative of all the forces across the country, and as a result it has been incorporated into this document to illustrate the wishes of the people using the service.

The outputs of those workshops have been considered in the preparation of this document. However, two clear messages came out loud and strong.

- The police service would like to see the introduction of the mobile fingerprint identification capability to all forces as soon as possible.
- Start with a basic service and build on it. Don't go for the 'all singing and all dancing' version at the beginning.

3. Purpose of this document

The purpose of this document is to identify and examine the various options that are available to the project board, to continue and develop the existing pilot capability into a country wide, national, service.

In considering the options available, it has been identified that because of the combination of choices available, the options numbers could be colossal when taking into account all possible permutations.

The methodology used in preparing this paper is explained below.

Clear principle factors in deciding which option to approve, are going to be timescales and funding.

The implementation of any decision made on the future national solution of a mobile fingerprint identification system will be determined by the option chosen.

Each of the options examined in this paper have implications in respect of funding and time it will take to deliver.

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It is important that when considering the options available that the expectations of the police service for a system to be delivered in the shortest time possible, are tempered against the need for securing funding, not to mention the feasibility of delivering the necessary components to make it viable.

In that respect it is also important that the expectations of the government (Home Office), the NPIA, and the police service in relation to timescales to achieve the national solution are examined and an agreement reached on what is required.

This document will now deal with a number of issues.

- The first issue will be the extension of the 'pilot'
- The second issue will be looking at the various options for the national solution, with the expectation that a preferred option will be identified to give clear direction to the project team.
- The third issue will look at options to exploit the current under use of the pilot central checking capability.

4. Methodology

It is necessary to ensure that those tasked with the decision making, are aware of the links and dependencies each option has, and what impact one decision may have on choices available further down the line. For example, if a decision 'A' is taken it may preclude the choices 'X' and 'Y' further down the line from being viable.

In order to best understand the various options, and their connections to each other, documents have been prepared to help the reader follow the logic and the explanations given in the form of flow diagrams or decision making 'trees'.

These additional documents should be read in conjunction with this narrative.

Essentially three broad options have been identified, and these are examined individually.

When considering the options, there are 5 clear principle issues which will affect the choices available. These have been identified and are examined individually.

The key issues are essentially technical in nature, and it may be that there is no need to opt for a specific solution, letting market forces deliver what is needed. However it is necessary to understand the implications if certain options are chosen in the timescales and costs that will be necessary for that option to be delivered.

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Essentially these principle issues can be correlated to specific branches in the 'decision making tree' (Appendix B).

An attempt has been made with each of the options to give an indication of expected costs, and timescales for procurement and implementation. It is very difficult to tie these down, as the choices made for the principle issues could have a dramatic effect on time and costs.

In all cases the minimum time and cost has been identified. Once the principles of the way forward have been agreed detailed planning can commence.

Each of the options can be readily assessed against the impact the option might have, in delivering against any overall time and cost constraint that may be imposed.

The project team are keen to adopt a method of "Evolutionary Development".

This essentially means that the project delivers a simple, workable solution that can be taken into use by the police service, whilst in parallel develop and deliver as 'upgrades' more advanced functionality and integration.

The reason for this approach comes from lessons learnt on other national projects. Users in the police service have been critical in the past that too much time is lost trying to deliver the 'all singing, all dancing' version, thereby missing the boat, and earning the phrase "delivering yesterdays technology today".

Costings and Timescales

Costings and timescales indicated in this paper can only be taken as being indicative rough orders of magnitude, as a detailed analysis has not been undertaken. The exception to this is the pilot extension cost which is set out in the original CCN.

Current Usage

Understanding the current pattern of use of the Lantern system is also likely to assist in the decision making of identifying the best option.

Thus the current usage of the system has been examined and later on in this document the results of that examination have been presented for information.

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Project options for pilot extension and national capability**5. PILOT EXTENSION BEYOND DECEMBER 2007.**

This is the most important and pressing item to be considered by the project board.

The current pilot is planned, and funded, to last until the 12th December 2007.

At that point, the devices will be taken back, the GPRS / CJX connectivity turned off and the matching capability within IDENT1 re-used elsewhere.

Should this be the case, a hiatus will occur between the end of the 'pilot' and the commencement of any national capability.

This could be potentially damaging to the police service, the credibility of the NPIA, and to the outcome of any possible national solution.

It is unlikely that any course of action to deliver a nationwide capability will be achieved by the end of 2007 and such a hiatus should be avoided at all costs.

As previously identified, in negotiating the change control notice (CCN) for Lantern on the IDENT1 contract, an option to extend the pilot for a further 12 months was inserted, with an indicative cost. To prevent any hiatus occurring this option MUST be exercised.

Pilot Extension – Stay as is – 10 forces 100 devices – Points to consider.

- This option would see the current 'pilot' continue in the same vein for a further 12 months.
- This will continue to restrict availability of the devices to the existing 10 forces.
- There have been a number of requests to deploy the devices to operations being conducted by forces who are not part of the pilot. One or two have been supported but this has met with some contractual problems regarding device numbers, and technical support. Resolving and supporting these requests has taken NPIA project staff away from their normal work. As Lantern successes continue to mount, it is unlikely that the project team, nor pilot forces acting as mutual aid, will be able to cope with the level of demand.
- By extending the pilot for another year, this will allow time to identify, develop and implement, a national solution and roll out.

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COST:- (subject to confirmation) **£ 386,000 (+/- 15%)**

TIME FRAME TO IMPLEMENT :- **BY 13th October 2007 the 10 pilot forces would continue as they are now. This would all happen in the background.**

RECOMMENDATION 1

Negotiations should be commenced with Northrop Grumman immediately to at least extend the current pilot on an 'as is' basis until December 2008.

This is to be done as soon as possible in order to meet the 13th October 2007 deadline.

6. CURRENT PILOT USAGE

To assist in the decision making processes it is beneficial to understand the current usage profile of the system.

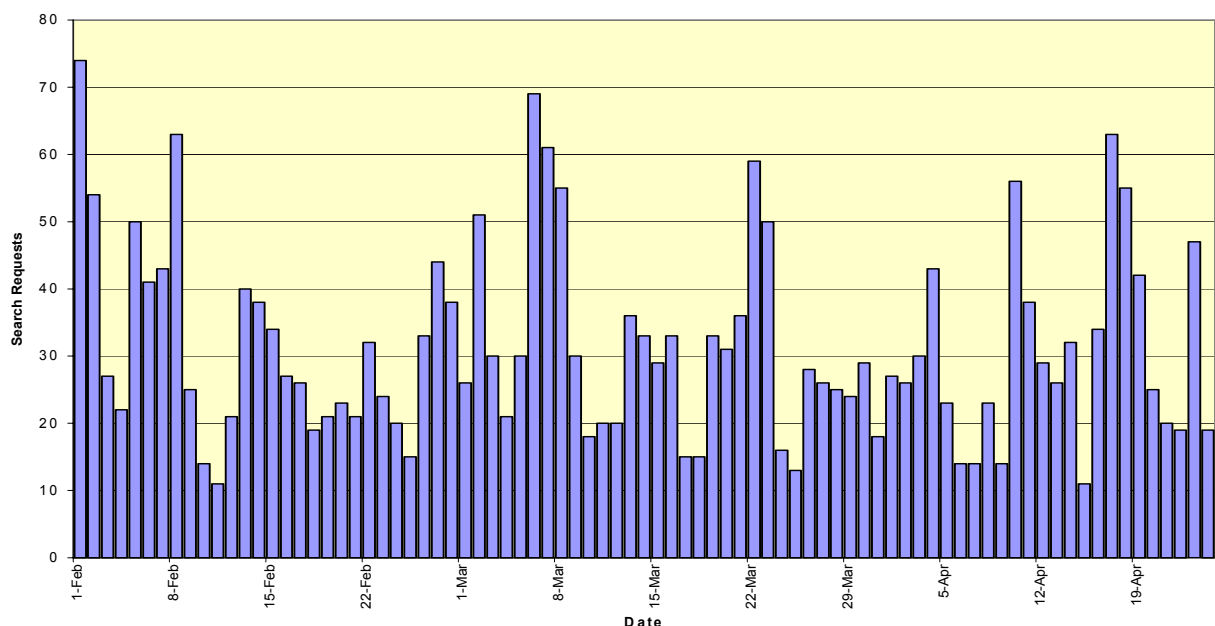
Analysis of the usage during the current pilot has been carried out by Northrop Grumman. Although primarily to establish the scalability issues needed for any potential full roll out to all forces, it also provides valuable information on the viability of any options that may be considered in the short, medium and long term.

The following three graphs illustrate their findings.

The period used for analysis is the 1st February to 24th April. This represents the period from the last force having rolled out, to a suitable cut off point to enable Northrop Grumman to produce an interim report. A full report will be delivered to the project by the end of July 2007.

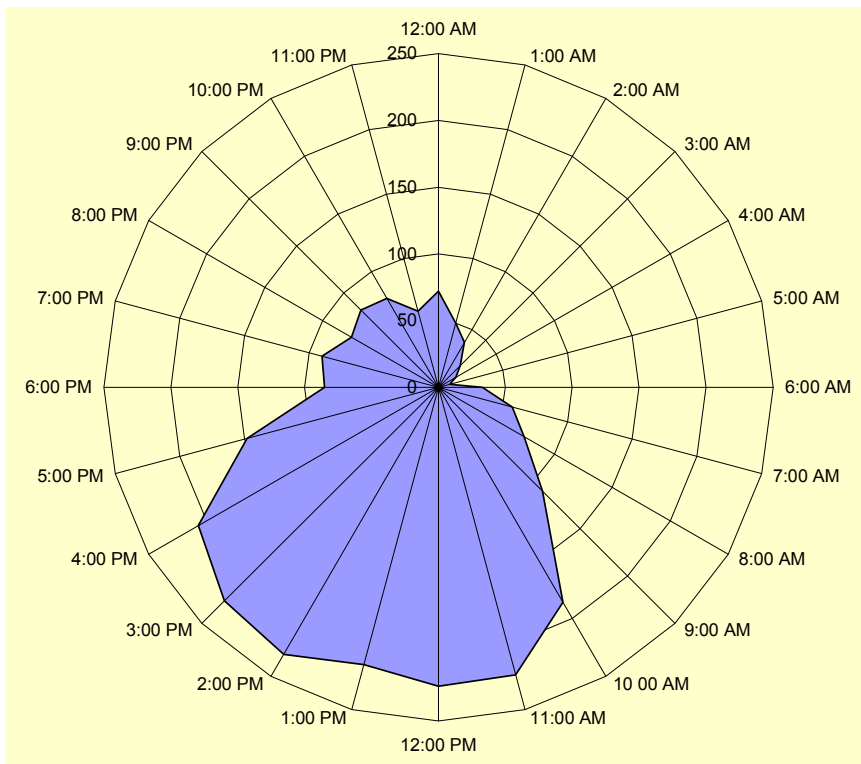
The project team felt it would be helpful if the information contained within the report were made available to the project board to assist in the future options deliberations.

Daily usage 1st Feb to 24th April 2007

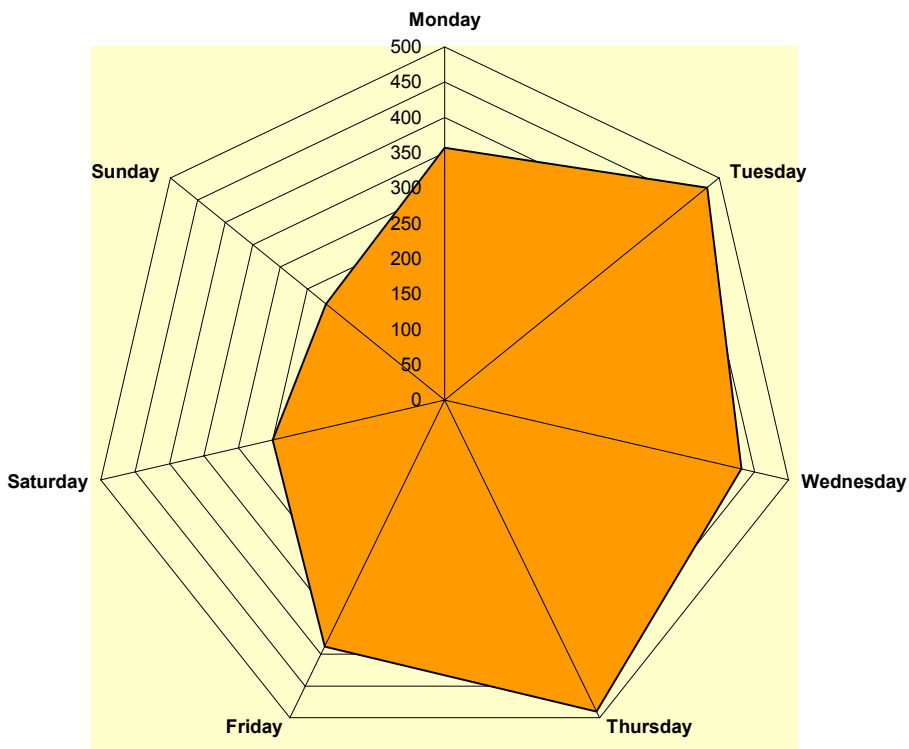


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Times of usage across 24 Hours.



Usage on Days of the Week



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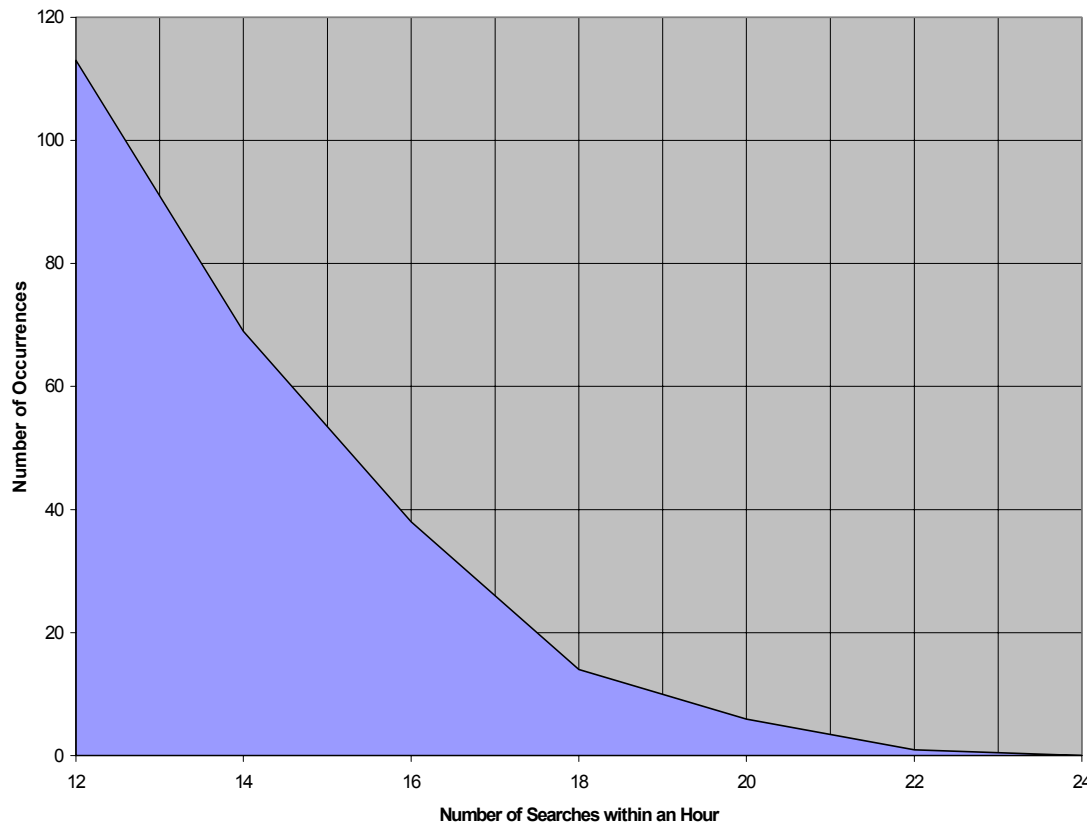
It should be no surprise that the pattern of usage is mainly during weekdays and during the day. This reflects the pattern of deployment by most ANPR units, who are the principle users of the device.

The Pilot system was set up to handle 200 searches per hour and to achieve a response time of under 5 minutes.

The response time has easily been achieved during the pilot with most responses being completed within a 2 minute time frame. This is most probably because the volume of checks being carried out is no where near the capacity planned for.

When looking at check capacity, two things have to be borne in mind – firstly that the checks are never going to be evenly spaced out across the 24 hour period, and secondly there are likely to be 'bursts' with several transactions arriving at or near the same time.

The graph below shows the frequency of search numbers per hour. The bulk of checks appear in the 12 to 16 checks per hour bracket, with occasional peaks of 20 -22.



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Northrop Grumman found it extremely difficult to analyse with any certainty the 'bursts' that occur from time to time.

What they did find was :-

A number of occasions occurred where there were bursts of 3 to 5 checks arriving with in a short space of one another. Unfortunately there appeared to be little consistency in the outcome.

- For instance on 14 occasions where 5 or more searches arrived, most were processed within the 5 minute timeframe.
- However on 27 occasions during non busy periods, where 3 checks arrived within a 5 minute period, they were processed in longer than 5 minutes.

Conclusion

When looking at the current usage, whether it be from total numbers of transactions, to hourly rates, to peak hours, the same conclusion can be made that the current existing capacity built for the pilot is being grossly under utilised.

It also has to be remembered that these findings are from an interim report, and more detailed analysis is likely to be forthcoming in the full report in July.

However, the information in this analysis does allow sound conclusions to be drawn and provide valuable guidance to any future system scalability.

As a side issue it also allows us to help identify if further numbers of devices can be used without any need to expand the central checking capacity.

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Before the key issues are considered , this paper will look at the 3 broad options that have been identified. These are set out below

7. NATIONAL SOLUTION PROCUREMENT OPTIONS

When considering the three options, any solution will have 3 main components.

Component 1 Fingerprint Matching Capability

Component 2 Transmission method

Component 3 Devices

These can be depicted thus:-

NATIONAL PROCUREMENT OPTION 1 – Keep same device and provider and expand to all forces

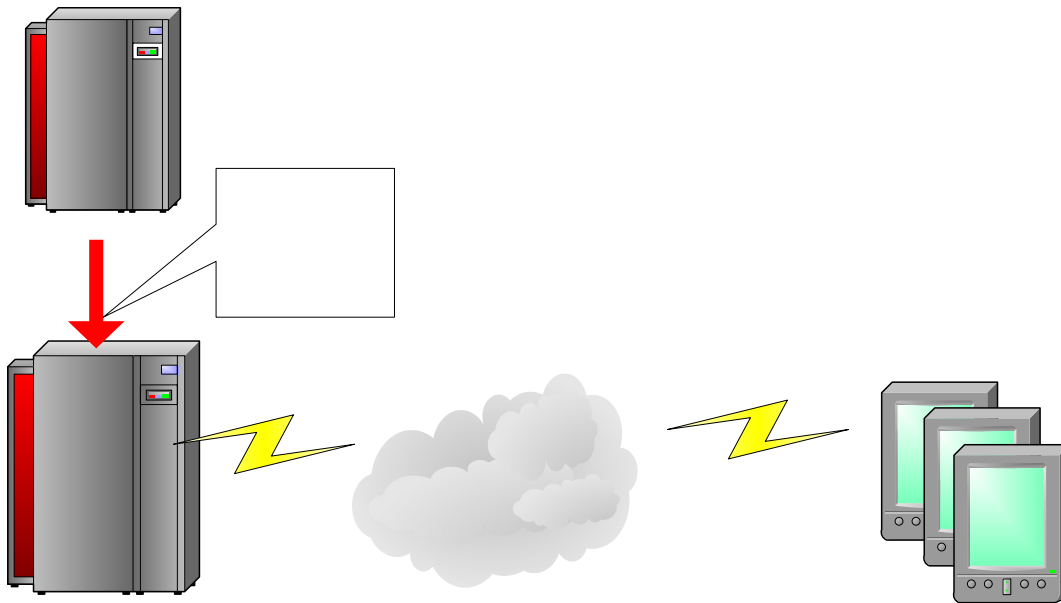


NATIONAL PROCUREMENT OPTION 2 – Keep the Fingerprint Database with IDENT1, and use devices provided by other suppliers



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NATIONAL PROCUREMENT OPTION 3 – Fingerprint Matching service and devices provided by independent companies. IDENT1 provides database with ‘raw’ fingerprint data.



These 3 options are now examined in a little more detail.

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7.1 NATIONAL PROCUREMENT OPTION 1 – Keep same device and provider and expand to all forces

This is probably the simplest and easiest option to achieve, and one that would lend it self to a quick implementation across the police service.

The option sees the devices being procured on a national scale from the provider used for the pilot (Sagem via NG).

The matching capacity at 'central' (IDENT1), is beefed up to accommodate the increased workload.

The Criminal Justice Extranet (CJX) connection between IDENT1 and the communications infrastructure is similarly revised to ensure it meets capacity requirements.

Communications provided by 3G / GPRS and Airwave (when available) GPRS sim cards should be provided and managed centrally, to obviate the connectivity problems experienced in pilot.

Arguments for option:-

- Tried and tested.
- Delivers the basic requirements.
- Easily implemented.
- Training and support have already been put into place for the pilot, and proven to be sufficient and effective. This can easily be expanded into the additional 41 forces.
- Extra devices would just be ordered and delivered to forces.
- Additional service integration is simpler as there is only one device to integrate with.
- Device and software upgrades simple to implement

Arguments against option:-

- Ties solution to one specific provider and one specific device
- Device may not be suitable for all policing applications
- May not meet 'best value' requirements of OGC reviews
- May not be achievable under 'single tender' option.
- May stifle research and development in external device manufacturers.

The solution is one that could be implemented very quickly but would not necessarily represent best value.

COST

**'Central' Upgrade to accommodate 15,000 devices
9 'stacks' @ £260k = £2.34 M**

Device costs – 15,000 @ £2,500 = £37.5 M (shared by forces?)

Training :- Possibly provided by NPIA via the old Centrex set up, and NG technical support.

Increase Help desk staff at NG

TIME FRAME TO IMPLEMENT

Mobilisation: 4 months

Device provision: 3 months lead time.

Training & Deployment:

From pilot – training for IT, users (train the trainers & cascade), and go live can be achieved in one week per force.

**Minimum 14 weeks based on 3 forces per week (42 forces)
(This would be dependant on the available training resources and NG engineers availability to commission devices and train IT service desks)**

Contingency: +15%

7.2 NATIONAL PROCUREMENT OPTION 2 – Keep the Fingerprint Database with IDENT1, and use devices provided by other suppliers

This option would see Northrop Grumman maintain the fingerprint database, and provide the fingerprint matching capability within IDENT1.

The interface that has been provided for the pilot, is capable of accepting fingerprint encodings (also known as templates), as well as, or instead of, the actual images (as provided by the pilot devices).

This option would allow other device providers, such as Identix, Motorola, and Crossmatch, to bid and provide devices to the forces.

It is envisaged that this option would see a centrally provided system made available for use. If forces wish to then take advantage of the system, they would purchase suitable devices to connect to it.

The important part of this option would be the accreditation and certification of a number of devices from different manufacturers. This would guarantee to forces that if a particular device is shown on a 'catalogue' (similar to GCAT) that they would have confidence that the device will work, and be sufficiently accurate.

Market forces would determine the types of devices that are available for connection, and they could range from simple fingerprint only devices, to more complex multi functional devices with a fingerprint capability built in.

A catalogue system would enable a centralised procurement framework to take place, with forces being able to be 'call off' their requirements against the framework, rather than have to go through the procurement process on an individual basis.

It is essential that a simple system of accuracy checking is established to enable current and new devices to be checked, assessed and authorised.

Northrop Grumman would be required to build the central architecture to accommodate the expected usage, and to maintain response times agreed within a national service level agreement.

Device type and communication type would be a matter of choice for individual forces.

Arguments for:-

- Utilises existing infrastructure which is tried and tested.
- Allows for easier integration of interoperability options using the fingerprint database at later date.

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- Depending on costing option, spreads costs away from central provision.
- Competition for device provision may drive costs down to forces.
- Complex multi functional devices could be introduced at any time
- Larger choice of different types of devices for different scenarios.

Arguments against:-

- No competitive costs for central matching – tied to existing provider.
- Not conducive to quick implementation, however this could be offset by an interim solution (see section 9).
- Device availability, is subject to the individual forces ability to fund. May create a 'have' and 'have not' situation.
- Multiple vendors introduces additional risk and complexity

COST

'Central' Upgrade to accommodate 15,000 devices
9 'stacks' @ £260k = £2.34 M

Device costs – up to 15,000 @ £1,500* = £22.5 M (shared by forces?)

*** average price per device.**

Training – The training will be device specific, coupled with some knowledge of how the central system works, along with results interpretation.

TIME FRAME TO IMPLEMENT

Mobilisation	4 months
OJEU & ITT	6-12 months

Selection, testing, and authorisation of appropriate devices 3-6 months initially. Ongoing authorisation process to be developed to accommodate new devices coming onto the market.

Procurement & delivery – 3 to 6 months

Training and deployment – 3 to 6 months depending on method used.

Contingency: +15%

Due to the relatively long timescales to implement this option, an interim solution could be put into place. For example the current pilot could be

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enhanced and a limited capability introduced to all forces in the interim period (see section 9).

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7.3 NATIONAL PROCUREMENT OPTION 3 – Fingerprint Matching service and devices provided by independent companies. IDENT1 provides database with 'raw' fingerprint data.

The essential part of this option sees the matching function being completely separated from IDENT1.

The fingerprint data held within IDENT1, is wholly owned by the police service. This option will see the fingerprint data being exported on a regular basis from IDENT1 to a separate 3rd party system (but still within the police service).

This option can offer a variety of possible solutions.

For instance:-

It could be that a sole provider offers a complete 'end to end' solution from the matchers to the capture device, including various communications methods.

It could also be that one provider supplies the matching capability, while a myriad of suppliers provide the devices.

Arguments for:-

- Gives option to design system from top to bottom.
- Does not tie police service to existing supplier.
- Competition for contract should deliver good value for money.
- Keeps service independent from other fingerprint work.
- Complete flexibility to enable any approach to be considered.
- May be able to host additional services such as FIND

Arguments against:-

- May cause problems for future integration and enhancement work.
- Database needs to be updated on regular basis.
- Could take considerable time to implement
- Still reliant upon connectivity to IDENT1

In 2006 the project team took the opportunity to use an external company to provide a document giving indicative costs to set up from scratch a system identical to that of the current 'Lantern' system.

It includes the setting up of the database, importing the data from an external source (IDENT1), maintenance of the database, providing the devices, and licensing the officers.

The costs and timescales are lifted directly from the document provided by the company New Zealand Biometrics. This company has since been bought out by other suppliers of fingerprint systems.

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COST:-

100 node matcher system providing end to end response time of 4.7 seconds

£315,000

20,000 devices @ £565 per device to include all software licences

£11,291,000

20% spares

£1,388,000

Software and licences inc upgrades

£700,000

Server application one off cost for 8 million records

£588,000

Application support annual fee

£117,000

Cost of importing 8 million records

£762,000

Annual support costs (20%)

£160,000

Police officer enrolment (100,000)

£100,000

Total cost of end to end system (inc devices)

£15,421,000

Total cost - Excluding device costs

£4,130,000

TIME FRAME TO IMPLEMENT :-

Between 18 to 22 months

RECOMMENDATION 2

It is recommended that **National Procurement Option 2** is selected as the most appropriate method to take the project forward.

8. PRINCIPAL KEY ISSUES OF ANY NATIONAL SOLUTION

There are a number of key issues that can be considered to be principal in the decision making process of any national solution, as they will most definitely dictate the direction the solution can take, and the time and cost involved in delivering that solution.

8.1 PRINCIPAL KEY ISSUE 1 - DEVICE SIZE

One clear issue to be considered is the actual device size. The device used for the pilot, is of a size and weight that does not lend it itself to be easily carried by officers on foot patrol duty.

The users have asked for consideration of the device to be made smaller, or to have the fingerprint functionality incorporated into a device already used by them on patrol (such as PDA's, Blackberry, etc)

In the device being used for the pilot, a single finger, optical fingerprint reader is used. This works on the principle of reflected light through a prism. The optical prisms govern the overall size of the fingerprint device.

E.g.

A single fingerprint reader of this type is the size of a computer 'mouse'.
A two finger reader is typically the size of a house brick,
And a four finger device the size of a briefcase.

This type of fingerprint reader has been chosen for its accuracy in checks involving what is termed '1 to many' ($1 \sim n$).

Other types of fingerprint reader do exist. These can best be described as capacitive, optical bar, and flat optical. Although the methods used for extracting the fingerprint information differ between the devices, their common feature is that they are all thin and flat, so could easily be incorporated into a device such as a PDA.

These applications are widely used in private industry for security type applications for verification of identity, and have been found to be very effective.

However the types of check that are undertaken are invariably termed as '1 to 1'. The device is essentially comparing a print offered by a subject against a set of prints previously enrolled against the subject name, or other identification token such as a smart card. It is answering the question " Is this the finger print of John Jones?", rather than the question, " who does this fingerprint belong to?"

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Where checks are made against a database, where the system is not directed to look at one particular set of prints (as described above) (a 1 ~ n check), the databases are usually small, and can involve a high false reject rate (FRR)(i.e. the database doesn't identify the individual).

This type of 'non identification' usually only means that the individual cannot gain access to the function they want to do, such as to enter a building, or log onto a computer, so does not present a particular huge problem apart from inconvenience.

The subject will usually have alternative methods to deal with their non identification, because they themselves want it resolved.

In the police environment non identification would have a much greater impact, as it effectively would mean a known criminal not being identified. (It is doubtful the criminal would want to seek alternative identification themselves.)

Along with a higher false reject rate, the devices typically also produce a higher 'false accept' rate (FAR) (wrongly identifying individuals as being on the database when they are not).

In a police environment this type of 'wrong' identification, has a potential to undermine the use of the device, as well as opening up the police service to potential civil proceedings for unlawful arrests. Although with any system that involves machine checking against machine, such misidentifications will occur, it is necessary however to keep them to very low levels.

The reason for these high FRR and FAR rates in capacitive or thin membrane readers, is probably due to the fact the reader samples a substantially smaller fingerprint area than the prismatic optical reader.

The industry leaders, current research, and the NPIA biometrics experts agree that these types of fingerprint reader are, as yet, not of an acceptable quality for the purpose to which we wish to use them.

It is important to note that the FBI only approve such devices for 'PIV' (personal identification verification). They still advocate optical devices for forensic quality examination.

To be able to use such readers, it may be necessary to stimulate the market, and research in these types of devices, to get the improved accuracy needed.

This approach would not lend itself to an early implementation.

Capacitive type devices have been used in Iraq and Afghanistan to good effect however no information exists in the public realm as to what the systems consist of, FAR & FRR rates, etc.

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Some claims of accuracy by manufacturers of capacitive devices are impressive, however it usually has been achieved by a proprietary end to end system including feature extraction algorithms that compliment the central encoded files.

Such capacitive or flat optical solutions cannot be completely discounted, but it would be up to manufacturers to adequately demonstrate that the devices they offer give sufficient accuracy with acceptable FAR / FRR rates.

RECOMMENDATION 3

In preparing system requirements for the tendering process, only accuracy, and associated False Reject / Accept rates should be specified. The burden will then be put upon manufacturers to demonstrate how their device meets that requirement. This should allow a broad spectrum of devices to be tested and approved.

8.2 PRINCIPAL KEY ISSUE 2 - ACCURACY

The accuracy tests conducted with the device currently being used on the pilot have shown a high degree of accuracy, typically 94 -96%. Although not as high as Livescan (99.98%), it is sufficiently high enough for police purposes as a 'screening' device on the street.

The original accuracy tests were conducted with a relatively small reference set (between 400 and 500 police eliminations), but these were 'launched' against a database of over 6.5 million. Operational use of the device has certainly indicated that the accuracy rate is probably higher than that achieved in the pre-pilot tests.

The device has also had a very low false accept rate (about 0.6 ~ 0.7%).

These accuracy rates have been achieved using only two 'flat' impressions of the subjects index fingers.

It has been commented upon that the accuracy rate of the device could be improved if more than 2 fingers were used in the checks.

It is true that the more fingers used in the comparison, the higher the accuracy.

It also reduces the amount of processing power needed when carrying out the checks. This is perhaps counter-intuitive but non the less is correct.

The reason the pilot used only two fingers, was to reduce the opportunities for police officers to make mistakes in the correct sequence of fingers.

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The central fingerprinting architecture is such that it relies on the prints being presented in a particular order and in a particular orientation.

Livescan, uses the two sets of 4 flat impressions taken first to determine the correct finger sequence of the rolled prints. If an officer attempts to take the prints in the wrong order, the Livescan device will detect the error and display it.

No such ability exists with the current lantern device. It will detect if the same finger is taken twice, but will not detect if the officer has taken left then right, instead of right then left. The result of the reversed sequence is that if the subject is on the database, they will not be identified.

By introducing more fingers into the process, it introduces the higher probability of the fingers being taken out of sequence. It increases the time the process takes on the street, and also increases the resulting file size to be transmitted (see communications later).

There is a direct trade off to be achieved between the numbers of fingers, the accuracy of the check, and the simplicity of the process at street level.

RECOMMENDATION 4

In preparing system specifications, it is recommended that the simple two process operation for obtaining fingerprints is retained.

This should not preclude multi finger devices from being put forward for approval if they can demonstrate that they meet the specifications.

RECOMMENDATION 5

It is further recommended that a system of accuracy testing is developed as a matter of urgency, to enable easy assessment of devices for approval.

8.3 PRINCIPAL KEY ISSUE 3 - IMAGES AND ENCODINGS (TEMPLATES)

This subject has an impact on several areas of the project, and contributes to the variability in the options to be considered.

The principle difference between the two, as far as the project is concerned, is that where an image of the fingerprint is captured, the whole image (which may be compressed, but none the less 'raw') is then sent to the central processing system, where the print is then encoded , and searched.

Encodings or fingerprint template, on the other hand, result from the process that the device first captures the image of the fingerprint. The device then processes the print on the device to extract the minutiae, from which an encoding or template is obtained. The resultant file is then sent to the central processing system to be searched.

The following table summarises the differences.

Images	Encodings / Templates
High quality	Quality dependant on device algorithm
Encoding done at 'central'	Encoding done at device
High processing power needed at central searching facility.	Less processing power at central
Device becomes searching algorithm independent	More processing power needed on device
	May drain battery quicker because of extra processing needed.
Large file sizes to be transmitted	Smaller files to be transmitted
'central' has the matcher licences	Individual Devices need licensing
Accuracy can be virtually guaranteed as the encoding and searching is done with the same algorithm.	If device algorithm not the same as the central matching system, additional translation software will be needed. May have reduced accuracy.

The key part to this issue is the file size of the fingerprint(s) that needs to be transmitted. This has a direct impact on the communications system that can be used to transmit it from the device for processing. It also impacts on where the processing takes place, the processing power required, and the licensing arrangements.

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The IDENT1 interface that has been constructed for the pilot, is capable of receiving and using encodings, but as yet this functionality remains untested.

The use of images means that the device being used to take the fingerprint is not tied to a particular algorithm. This would allow multiple manufactures to supply devices, provided they could meet some minor requirements.

The use of encodings may not be a barrier to allowing multiple vendors. The reason for this being is that essentially there are only 3 or 4 encoding algorithms. Thus the manufacturers are now building their devices to be 'algorithm agnostic'. This meaning that the device manufacturers will load whatever algorithm is to be licensed. Essentially the same algorithm as used in IDENT1 (Sagem) could be licensed for each device. This should help keep accuracy levels high.

Where the device provider cannot use the same algorithm, conversion software does exist. However there is an impact on accuracy which would need to be assessed.

Using encodings essentially will also future proof the system, and will allow non optical readers to be used provided they are able to meet the accuracy requirements.

RECOMMENDATION 6

It is recommended that the IDENT1 interface continues to enable the use of encodings and images in any future solution. This will allow multiple vendors of devices to be considered, and future proof the solution.

8.4 PRINCIPAL KEY ISSUE 4 - COMMUNICATION METHODS

For the pilot, the method of communication being used is GPRS.

This method was decided upon due to the fact that the file sizes being sent were relatively large (20Kb), and that at the time the pilot was commenced AIRWAVE, the police tetra based system, was not able to prove that it could handle the file sizes in an acceptable time. Its poor data rate (less than 4Kb) and 'single slot' for data, in its transmission spectrum, suggested that this would induce a significant delay in transmission of the fingerprint, and could impact significantly on the AIRWAVE system.

Initially the project was looking at a vehicle based system, which may have been able to take advantage of the AIRWAVE system as the transmission medium, assuming the system was able to transmit the fingerprint files.

However, a technological improvement in communications with Personal Digital Assistant (PDA) type devices, meant that a self contained device could be used, which better suited the police requirements. It also represented a huge leap forward technologically allowing the project to remove an intermediate 'step' in any final solution.

The vehicle based solution was thus abandoned in favour of a self contained solution. This decision also precluded AIRWAVE from being used for the pilot, as all the self contained, mobile fingerprinting devices considered suitable for the pilot, are Personal Digital Assistant (PDA) based.

At the commencement of the pilot there was no PDA available that was tetra / airwave enabled, that could be used in the fingerprinting devices. At the present time there is still no commercially available PDA that is AIRWAVE enabled. (see below re experimental device).

AIRWAVE, since the pilot has been in operation, has made moves to try and improve its data handling capabilities, and promises to be able to handle larger size data files.

The project team have worked closely with the AIRWAVE / mobile data team to examine the viability of AIRWAVE as the data carrier.

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An AIRWAVE enabled prototype PDA is now available and tests have been recently conducted to assess its suitability. These tests, using multi slot data capability on the Airwave system, have shown that it is possible to use the Airwave system to send fingerprint images to IDENT1, and receive responses in time frames comparable to that achieved by GPRS.

The response times could be further improved if only encodings are used as the resulting file sizes are much smaller and will take less time to transmit.

However, although Airwave has now been shown to be able to cope with the large file sizes associated with fingerprint images, the problem still exists that a commercially available, Airwave enabled PDA does not exist. This may be resolved in the long term if PDA manufacturers find it financially viable to produce them.

In the short term this may severely hamper mobile fingerprint manufacturers in providing an Airwave enabled device. This is because the mobile fingerprinting devices almost without exception, are commercial PDA based.

Thus if AIRWAVE is able to provide the communications, there may not be a device capable of taking advantage of that method either in the short or medium term.

The availability of devices aside, both Airwave and GPRS/3G have their advantages and disadvantages, which can also impact upon the decisions made by forces on the devices that they will need.

These are summarised in the table below.

AIRWAVE	GPRS / 3G
At present cannot handle large file sizes expediently (-)	Can handle large file sizes expediently (+)
Has secure communications (+)	Needs additional security programmes to protect transmissions (-)
PDA not generally available to device manufacturers (-)	Uses COTS types of PDA, and communications programmes. (+)
Guaranteed to be available in times of crisis, as it uses own system. (+)	May not be available in times of crisis as it uses public networks (-)
Restricted to use within the UK (-)	Can be used anywhere as long as PDA communications are tri / quad band and SIM is enabled for roaming. (+)
Coverage is as good as each force's communications coverage. (+)	Coverage can be a bit 'patchy', and dependant upon 3 rd party provider. (-)

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It is interesting to note that current mobile data trials using PDA's has chosen to use GPRS as the transmission medium rather than Airwave. However this may be directly related to the previous observation made about the dearth of commercially available Airwave enabled devices.

RECOMMENDATION 6

In setting system specifications, it will be necessary to ensure that both 3G / GPRS and Airwave can be accommodated, (not necessarily in the same device), so that forces can choose to have either system.

For Disaster Victim Identification, and other requirements such as travelling football fan identification abroad it is imperative that 3G/ GPRS is used.

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Project options for pilot extension and national capability**8.5 PRINCIPAL KEY ISSUE 5 – FUNDING**

Funding will inevitably be the major factor in any proposed roll out to all forces.

Currently the project cover the costs of providing the devices on lease from Northrop Grumman, along with service and support costs.

The 10 police forces engaged in the pilot, provide the first level of support for the devices, as well as paying for the cost of the GPRS data transmissions according to their own arrangements with the service providers. Thus costs to forces are minimal.

This may not continue to be the case when considering a national system.

Many forces may wish to own their own devices, as part of their own asset management, rather than leasing them.

One device type may not meet all the needs for the various deployments within the police service, so a catalogue of devices may need to be developed according to the types of deployment they are being used for.

Depending on what level of cost is involved, the take up of the service by forces may be restricted, despite the obvious advantages that having such a device may bring.

Thus serious consideration needs to be given as to the types of funding methods that can be used.

The methods can be summarised as being.

- Fully funded from the 'centre' (home office), as a centrally provided service as like the PNC, being 'top sliced' from overall police funding
- Shared funding between home office and the forces, in a manner similar to Livescan.
- Costs fully borne by the forces.

With force budgets continuing to be squeezed, it is hardly surprising to note that the preferred option of the forces is for the solution to be centrally funded.

Unfortunately pressure on central government budgets is equally as strong and thus may not be able to provide the required level of funding.

Some forces both inside and outside the pilot, have voiced the fact that they would be willing to find funds to purchase the devices / or service but it would dependant upon the costs.

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Clearly larger forces may have the ability to find sufficient funds to finance operationally viable numbers of devices more easier than smaller forces. The benefits identified to policing are such that any restrictions on deployment because of the lack of funds should be removed.

One way of achieving this could be to allow forces to offset expenditure on Lantern devices / services against the annual savings and efficiency requirements.

It is important that any decisions on funding methods are made early enough to allow forces to include any funding requirements in their 2008/9 budgets.

RECOMMENDATION 7

Once the option to go forward has been agreed, urgent talks are had with NPIA senior executives, and the Home Office to agree funding method.

This agreement should be reached in sufficient time to allow all forces to consider their requirements for 2008/9 budgets. (this usually takes place in late September / early October)

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9. PILOT EXTENSION - Opportunities to exploit under usage

The usage analysis highlights an under usage of the current capacity. This under usage could be exploited to provide a modest expansion of the pilot as an interim to the final national solution becoming available.

The justification for an extension of the pilot, can be drawn from the huge interest that is forthcoming from forces outside the pilot, as well as the pilot forces themselves wishing to expand their areas of operation and device availability.

The volume of success stories coming back from forces, and the benefits that are already being delivered in measurable quantities, makes it almost seem criminal to restrict those benefits to a small number of forces and users.

It must be understood that a fine line has to be walked when considering any expansion, to avoid any 'de-facto' solution being given to the service, that stifles future development and opportunities to keep costs down through competitive market forces.

It is with all that in mind, that the project board are asked to consider the following options that are available to exploit the current under usage of the existing pilot checking capacity.

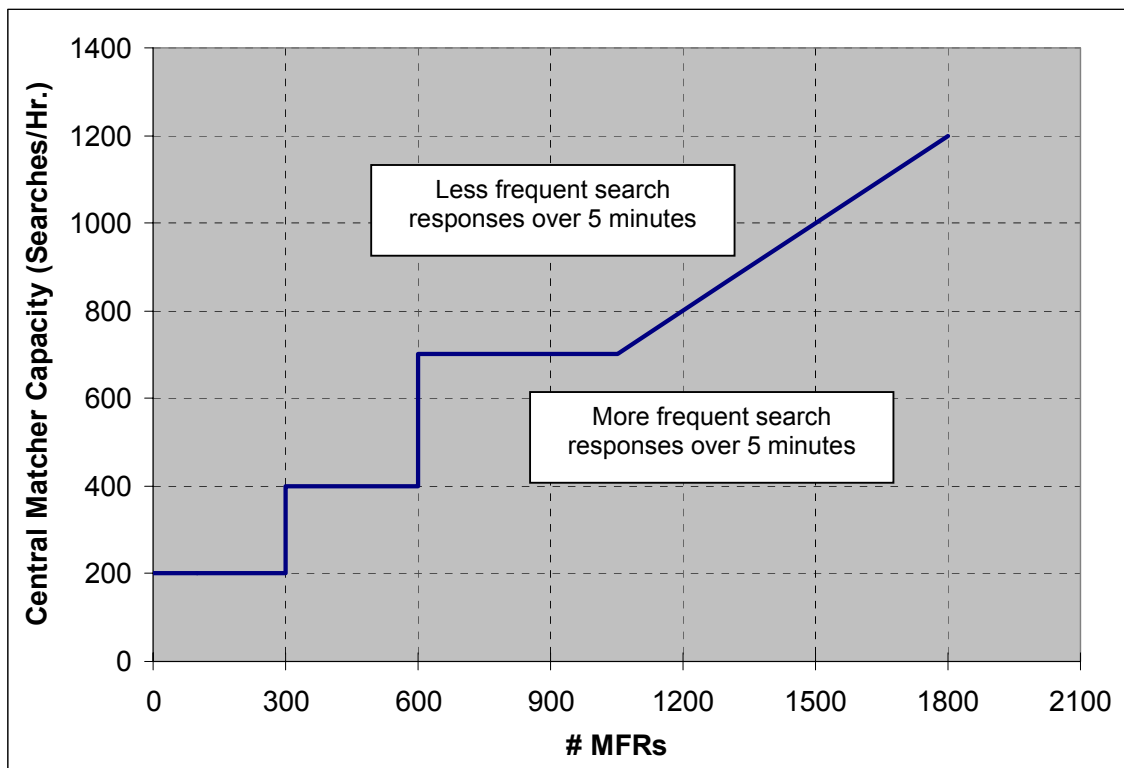
- **Expansion Option A - Keep the 10 forces and expand the number of devices in each force**
- **Expansion Option B - Expand the number of forces, but limit numbers to 10 (or so) per force**

Before any consideration can be made for an expansion of the current pilot, it is necessary to identify to what extent can the current system be expanded, and what risks are associated with any decision on numbers.

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The following graph illustrates what Northrop Grumman believe to be the impact on device numbers against central matching capacity. As can be seen the graph shows that the current 200 searches per hour can support up to 300 devices without the need to expand the matching capacity in 'central'.

If 600 devices were to be deployed, a central matching capacity of 400 searches per hour would be needed, and a capacity of 700 searches per hour could support around 1000 devices.



These figures should be seen as the 'safe bet' to achieve the response times of less than 5 minutes.

It needs to be understood that more than 300 devices could be deployed with the central matching capacity remaining at 200 searches per hour, but to do so, would increase proportionally the likelihood of more instances where a 5 minute response would be exceeded.

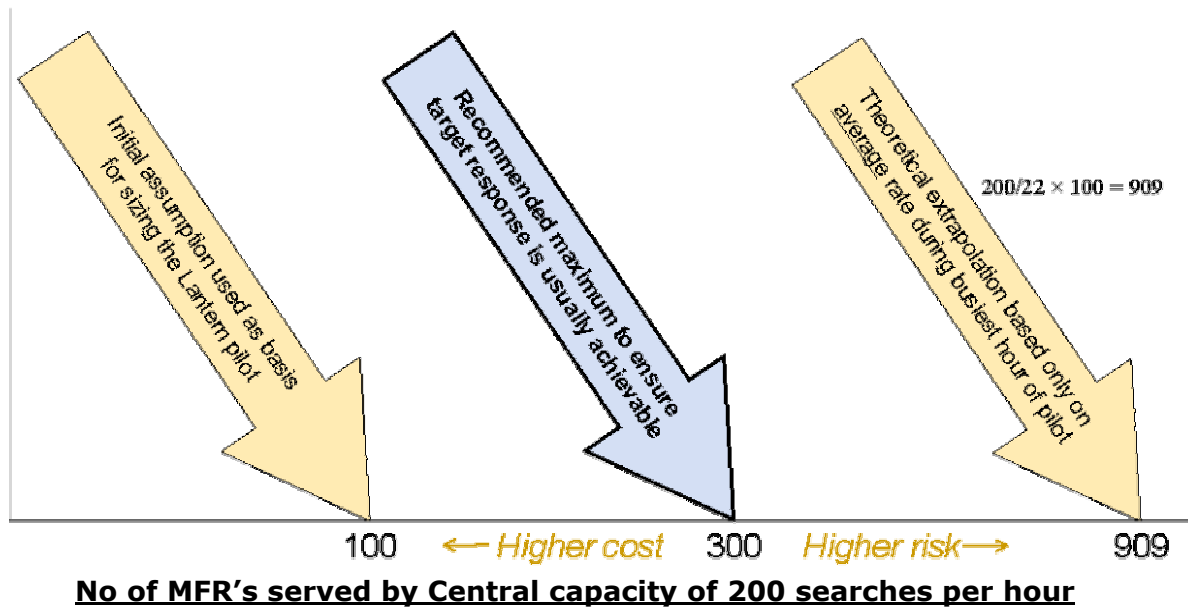
The capacity argument above also assumes that the current pattern of use (mainly week days during the day) is continued in any further deployments.

If the further deployments were purely in support of ANPR this may be the case, However if the expansion were used to support general policing activities, this

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could perhaps see the use being spread more evenly, or certainly wider across the 24 hour / 7 days a week

The graph below shows that a theoretical extrapolation of the peak transactions per hour currently achieved in the pilot (22) can be used to calculate the possible number of devices that a capacity of 200 checks per hour could support.



Thus it can be seen that a number between 300 and 900 devices could be deployed using the existing capacity.

The risk identified being that the larger the number of devices over 300, the increased likelihood that search times on occasions of peak usage would exceed the 5 minute response parameter set for the pilot.

One further thing to be borne in mind is that in the current transactions, the vast majority of the overall transaction time is taken up by the encryption, transmission, and decryption of the fingerprint and result data, rather than the time spent on the matchers.

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Expansion Option A - Keep to the 10 pilot forces and expand the number of devices in each force

This is the simplest option to expand the pilot. Training and support is already in place, and all it would require is the supply and commissioning of additional numbers of devices.

This option would be wise to limit the numbers of devices to the 300 identified by Northrop Grumman as being the optimum number of devices that can be supported by the current capacity limitations (200/hr).

300 devices would give an average of 30 devices per force. Forces currently have on average 10, so this would see an additional 200 devices being deployed, with a commensurate number of spares being made available (currently 10%)

It would be advisable to allocate these additional devices in proportion to force establishments.

COST:- 200 devices @ £2,500 = £500,000
300 devices @ £2,500 = £750,000
10% spares 20 = £50,000 30 = £75,000

TIME FRAME TO IMPLEMENT :- dependant on manufacturer
Believed approximately < 3 months from time order placed.

Hurdles/ Items to consider :-

1. Funding – Who pays for the devices
2. Will the devices still be subject to lease as per the first 100
3. Current device is obsolete, will the original 100 be replaced with 'new' device.
4. GPRS or Airwave?
5. CJX capacity
6. Certificate Authority – capacity, servers, hosting

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Expansion Option B - Expand the number of forces, but limit numbers to 10 (or so) per force

This would see the remainder of the forces (41) in England, Scotland and Wales getting a number of devices each, similar to the numbers given to the pilot forces.

If a limit of 300 devices is imposed this would see a distribution of 5 devices on average to the remaining forces. This number would probably not be worthwhile deploying in some of the larger or more rural forces.

If an average of 10 were deployed to each force in line with the current pilot forces, this would take the total number of devices to 500 (including the 100 already deployed).

This number, if the report by Northrop Grumman is taken into account, could introduce a significant risk that the frequency of times the checks exceeded 5 minutes.

COST:- 400 @ £2,500 = £1M
500 @ £2,500 = £1.25M
Spares 50@ 2,500 = £125,000

TIME FRAME TO IMPLEMENT :-
Device provision :-< 3 months lead time .
Training & Deployment :- 14 weeks based on 3 forces per week (dependant on training resources and NG engineers)

Hurdles/ Items to consider :-

1. Funding – Who pays for the devices
2. Will the devices still be subject to lease as per the first 100
3. Current device is obsolete, will the original 100 be replaced with 'new' device'.
4. GPRS or Airwave?
5. CJX capacity
6. Certificate Authority – capacity, servers, hosting

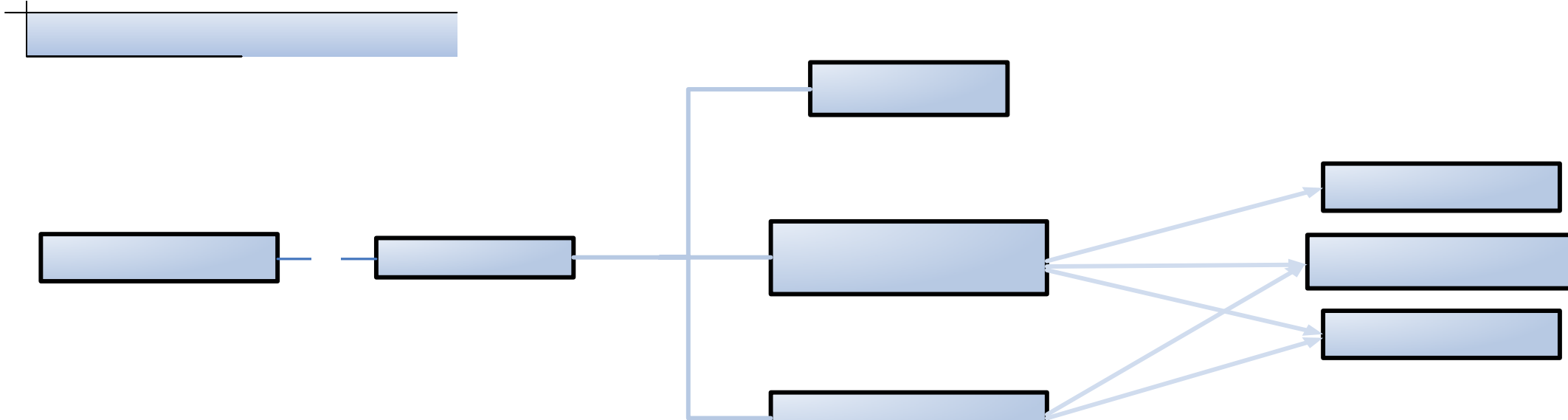
RECOMMENDATION 8

It is recommended that Expansion option B is undertaken if expansion to the pilot is agreed. This will enable a limited capability to all forces while the final solution is developed

Appendix A - Costing assumptions

1. Devices chosen are only available to police officers on duty
2. PCSO's are excluded from those persons requiring use of the device as the dormant legislation restricts use to Police Officers only.
3. Devices are only available to the 140,000 police officers of the rank Constable to Chief Inspector
4. Shift patterns adopted by UK police forces allow a maximum of 1/3 of establishments to be on duty at any one time (approx 46,000)
5. Of the 46,000 approximately 1/3 are unavailable due to sickness, courses, and leave. (leaving 30,000)
6. Devices would not be issued on a 1 to 1 basis, more probably a 2 to 1 ratio. (15,000)
7. Even if the capability were provided on an individual basis, it is unlikely the system would see more than 30,000 concurrent users.
8. All costings are based on the figures provided by NG in their CCN proposal for the Lantern Pilot, unless specifically attributed elsewhere.
9. Device cost for pilot was estimated at £2,500 each. It is assumed that the cost included hardware, and all software licensing.
10. 'Central' upgrade to handle 15,000 devices. Each 'stack' of processors can handle up to 1800 MFR's therefore 15,000 will require 9 stacks.
11. Each stack has 15 banks of matchers. The Pilot only had one stack with 4 banks of matchers and cost £259,600

Appendix B - Decision making tree - Lantern Options



Stream A – Expand current capabilities
Use Ident 1 and Current Sagem device

