To examine emerging police use of facial recognition systems and facial image comparison procedures. Israel, the Netherlands, the United Kingdom, the United States of America, and Canada.

I understand that the Churchill Trust may publish this Report, either in hard copy or on the internet or both, and consent to such publication.

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Signed  
Jason P Prince

Dated
To examine emerging police use of facial recognition systems and facial image comparison procedures

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The Winston Churchill Memorial Trust

Section Canada

Canada

Canada

Canada

Canada

Canada

Services (CJIS)

United States of America

Image Analysis Unit (FAVIAU)

United States of America

United Kingdom

United Kingdom

United Kingdom

Israeli National Police (INP)

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Support For "Latent" Facial Images

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EUROPEAN NETWORK OF FORENSIC SCIENCE INSTITUTES (ENFSI) DIGITAL IMAGING WORKING GROUP (DIWG)

Summary of Research Gaps Identified in this Report

CONCLUSIONS AND RECOMMENDATIONS

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10.

1. Facial Image Comparison – A Developing Forensic Science Discipline

2. Facial Image Comparison Roles and Outcomes

3. Forensic Facial Image Comparison Training

4. More Court Attendance For Facial Image Comparison Staff in the Future

5. Facial Image Comparison Areas Also Have Expertise in Forensic Photography and Image/Video Analysis


7. Forensic Facial Image Comparison is Time Consuming and Resource Intensive

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Concluding Remarks

APPENDIX 1: OVERALL AGENCY STRUCTURES AND STAFFING

Israeli National Police (INP) - Criminal Album Unit

Netherlands Forensics Institute (NFI) – Image Analysis and Biometrics

United Kingdom – Home Office Science – Centre for Applied Science and Technology (CAST) – Identity Assurance

United Kingdom - London Metropolitan Police – Audio Video Laboratory (AVL)

United Kingdom - London Metropolitan Police – Metropolitan Intelligence Bureau (MIB)

United Kingdom - London Metropolitan Police – Multimedia and Biometrics

United States of America – Federal Bureau of Investigation - Forensic Audio, Video, and Image Analysis Unit (FAVIAU)

United States of America – Federal Bureau of Investigation - Criminal Justice Information Services (CJIS) – Facial Analysis, Comparison and Evaluation (FACE) Services Unit

United States of America - New York Police Department (NYPD) – Real Time Crime Centre – Facial Identification Section

Canada - Royal Canadian Mounted Police (RCMP) - Canadian Criminal Real Time Identification Services (CCTRLIS) – Biometric Business Solutions (BBS)

Canada - Royal Canadian Mounted Police (RCMP) – Forensic Facial Imaging Specialists

Canada - Canadian Border Services Agency (CBSA) – Video Surveillance and Biometrics Section

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INTRODUCTION

In Australia a number of Commonwealth and State agencies have facial recognition systems and are conducting facial image comparisons for identification purposes, including:

- Australian Federal Police
- Australian Customs and Border Protection Service (Smart Gate)
- Department of Defence
- Department of Foreign Affairs and Trade (Passports)
- Department of Immigration and Citizenship (Visas)
- New South Wales Police Force
- Victoria Police
- Western Australia Police
- New South Wales Roads and Maritime Services
- Queensland Department of Transport and Main Roads
- South Australian Department of Planning, Transport and Infrastructure
- West Australian Department of Transport
- VicRoads [Victoria]

The facial recognition systems in use have different capabilities and different types and qualities of facial images in their galleries. The method and purpose for how images are found and matched from facial recognition systems, or how they are compared from other sources, varies greatly. Workloads, image qualities, techniques and tools, available human resources (especially the amount of time allowed to determine an outcome), forensic requirements, conclusion scales and outcomes, all vary greatly.

This is not to say there is a lack of expertise or that agencies are lacking appropriate processes and training, and it is not surprising given how such systems are compared to other intelligence tools and forensic disciplines. In order to maximise the potential of facial recognition systems, and for facial image comparison to mature fully into a forensic discipline alongside the likes of fingerprint examination, best practices need to be identified and preferably recognised internationally. Whilst facial recognition system use and techniques will keep developing, the way content is managed within these systems and face comparison processes should ideally be aligned with, as yet, non-existent internationally recognised standards and certification processes.

The broad objective of this Churchill Fellowship has been to improve the ways that police and other agencies in Australia can use facial images to support investigations and for evidence at court. The intention has been to understand where foreign agencies are now but also where they see these use cases, procedures and systems going in the future, to allow Australia to benefit from their experiences, expertise and knowledge. It has also been to see how Australia can contribute to the development of such best practices and standards for system use and processes by establishing ties with experts and existing collaboration efforts by virtue of visiting them as part of this Fellowship.

The countries and agencies visited as part of this Fellowship were identified from their public presence at biometrics and forensics conferences, from their involvement in ongoing research in these areas, and from their membership of international fora such as the Facial Identification Scientific Working Group (FISWG), which is highly active in these areas. The author would be very interested in making further contact with agencies in other countries, especially from regions that proclaim to have a depth of expertise in these areas that were not visited in this Fellowship trip, in order to identify new use cases, research and best practices.
ACKNOWLEDGEMENTS

I want to thank the Winston Churchill Memorial Trust for awarding me with my Fellowship. I feel very honoured by the Trust’s decision, especially the New South Wales selection panel, in recognising the worth of this project and having faith in me to undertake it. I am very grateful for your endorsement for me to undertake this research project, and I hope that this report and my ongoing work in this area, using the opportunities only made possible by my Churchill Fellowship, confirms your confidence in me.

There are a number of other organisations and people that have made my Fellowship possible.

I want to thank the Australian Federal Police (AFP) for their support in allowing me to develop the expertise I have in facial recognition systems and comparison, and to continue this work with my Churchill Fellowship. I particularly wish to thank those who I have worked with whom have encouraged and backed my work over the years. This thanks begins with Karen Shirley for getting me involved in facial recognition systems, and her inspiration and support. Thanks also goes to Detective Superintendent’s David Nelson, Ben McQuillan, and Darren Booy, and Federal Agent Karen Drake, for your professional guidance, help and trust during our development of facial recognition systems to support AFP operations over these years.

And on the facial image comparison side, I must thank those in the AFP Forensic and Data Centres (F&DC) management, who permitted and supported me to go on the Fellowship, and are at the heart of supporting our ongoing research and collaboration with other police forces to establish facial comparison procedures and standards, and hopefully one day have this recognised as a forensic discipline. They are; the National Manager F&DC, Assistant Commissioner Julian Slater; the Manager Forensic Operations, Commander Mark Harrison, and especially my manager, Coordinator Biometrics, Dr Simon Walsh. I very much appreciate your vision and trust that is allowing us to develop these capabilities and expertise.

I want to again thank my manager Simon, as well as one of the leading facial recognition system experts, Dr Brett McLindin of the Defence Science Technology Organisation (DSTO), for both being my Fellowship referees.

Simon and Brett, I very much appreciate both your kind words and recommendation to the Trust that has led to my success in becoming a Fellow. My journey would have not been begun without you both. Thankyou.

I need to acknowledge the great assistance of the foreign AFP Post staff responsible for the countries I visited, who assisted in organising my clearances and provided assistance with my travel, especially the efforts of London and Washington Posts.

I wish to thank Rebecca Heyer DSTO who was kind enough to help me wrangle the 30,000+ words here whilst finalising her PhD thesis.

My Fellowship would not have been possible without the access and time of the many foreign law enforcement agencies and their kind staff whom I met with. It was inspiring to see your passion for your work during our discussions and to see the cutting edge work being done with systems, demonstrated through case studies and examples that have been so valuable in proving insight for this report.
I wish to also highlight my great appreciation for the unexpected generosity made by some of my hosts in assisting me with my travel making my journey much easier, and for the time many of you made to show me a little of your countries and lives, notably; the Israeli National Police, London Metropolitan Police, both areas of the Federal Bureau of Investigation (CJIS and FAVIAU), the US Department of Defense’s Biometric Identity Management Agency, and the Royal Canadian Mounted Police. I hope that I can be as generous in return one day. I am very thankful to you all and look forward to our ongoing collaboration in this dynamic field.

And I must thank my family. Firstly, my sister Mandy and her family who were kind enough to look after me whilst I was in London. And secondly to the grandparents. To undertake this Fellowship I had to leave my wife with our two very young children to care for a month and a half. Fortunately we were blessed to have the help of my parents, Doug and Vivien, and my wife’s parents David and Ann, who provided so much willing support to them in my long absence.

Lastly, to my loving wife Tara, for her encouragement and sacrifice that has made possible my Fellowship odyssey, for this I am eternally grateful.
EXECUTIVE SUMMARY

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Project Description

To examine emerging police use of facial recognition systems and facial image comparison procedures, from law enforcement and forensics agencies in Israel, the Netherlands, the United Kingdom, the United States of America, and Canada (2012).

Key Findings

1. Adoption of facial recognition systems is a major driver for the need for facial image comparison skills and tools – especially for the poorer quality images that come from crime scenes.

2. A key limitation for facial recognition systems and facial image comparison continues to be the quality and aspects of facial images available. Where possible, police should seek higher quality images of different angles of the head, following best practice standards for capture, to maximise the chance of detection and the positive identification of criminals.

Facial Image Comparison

3. Facial image comparison in support of police work is a relatively new and rapidly developing area for many agencies, especially in terms of being an accepted forensic discipline such as fingerprints. The main international collaboration for facial image comparison standards and best practice is being undertaken within the Federal Bureau of Investigation’s Facial Identification Scientific Working Group (FISWG). This group, whose membership is made up of the agencies visited in this Fellowship as well as other government agencies and academics, is the key to establishing standards and best practices for face comparison for international adoption. Participation in FISWG’s document development process and its biannual meetings is a way for agencies to contribute, as well as to align and adopt these best practices and standards as they are established.

4. Forensic facial image comparison staff require extensive training, awareness, experience and testing in a range of issues typically over years, which include: forensic photography; facial recognition system theory and use; image analysis, authenticity and enhancement; video analysis and enhancement; detailed head/facial anatomy including issues such as aging, injuries and surgery; statistics and probability; research methods, and evaluating and using empirical evidence; bias and human errors; facial comparison practices; exposure to and understanding of other forensic disciplines; morphological analysis; tools such as Adobe Photoshop; legal studies, advocacy and court training; and plenty of supervised practice on images with ground truth, as well as real cases, to develop their expertise.
Facial Recognition Systems

5. Adoption of facial recognition systems is proving successful in the identification of offenders all over the world, demonstrating that even with poor quality images, a face alone can lead to an arrest and/or intelligence outcomes using these systems.

6. FR systems should be able to filter on image face quality and other metadata to compensate and improve biometric search accuracy.

7. There is an expectation that those using facial recognition systems may need to go to court if the outcome of their facial reviews to find a match forms part of a case.

8. Facial recognition systems presently lack good integration into forensic facial comparison procedures due to the lack of forensic image enhancement and preservation, so original images need to be available for proper forensic facial image comparison.

Dissemination and Implementation of Findings

The findings of this report will be disseminated in the following ways (this also covers the distribution of classified versions):

• Distribution and presentation of the findings within the Australian Federal Police’s Forensic and Data Centres branch (AFP F&DC).

• Distribution and presentation to other police services and relevant law enforcement, defence and national security agencies across Australia.

• Distribution to other Commonwealth and State agencies using facial recognition systems and undertaking facial image comparisons; including Facial Biometrics Centre of Expertise (FBCoE) presentation.

• Distribution to the Australian New Zealand Policing Advisory Agency National Institute of Forensic Science (ANZPAA NIFS).

• Distribution to the Australian and New Zealand Forensic Science Society (ANZFSS).

• Presentation at the annual Biometrics Institute conference in Sydney in May 2013 (pending approval).
FELLOWSHIP PROGRAMME (11 OCTOBER – 27 NOVEMBER 2012)

The following is a list of countries, their agencies and other meetings visited as part of this Fellowship. In some cases agencies have not been documented here for security reasons, although where appropriate and permissible their contributions are incorporated into this report unattributed. Anyone wishing to contact any of the agencies listed here should provide to me their contacts details and the specific reasons for their request, so that it can be forwarded on to allow these agencies to decide if and how they wish to establish a relationship with those interested in their work.

Jerusalem, ISRAEL (12-16 October 2012)
  Israeli National Police – Criminal Album Unit

The Hague, NETHERLANDS (18-19 October 2012)
  Netherlands Forensic Institute
  Europol

Sandridge, UNITED KINGDOM (22 October – 23 October 2012)
  Home Office – Centre for Applied Science and Technology (CAST)

London, UNITED KINGDOM (24 October – 2 November 2012)
  London Metropolitan Police – Audio Video Library
  London Metropolitan Police – Metropolitan Intelligence Bureau
  London Metropolitan Police – New Scotland Yard
  London Biometrics 2012 Conference
  UK Biometrics Working Group quarterly meeting
  International Face Collaboration (IFC) annual meeting

Quantico, Virginia, UNITED STATES OF AMERICA (5-9 November 2012)
  Facial Identification Scientific Working Group (FISWG) meetings
  Federal Bureau of Investigation – Operational Technology Division
    Forensic Audio, Video, and Image Analysis Unit (FAVIAU)

Clarksburg, West Virginia, UNITED STATES OF AMERICA (12-13 November 2012)
  Federal Bureau of Investigation
    Criminal Justice Information Services (CJIS) Division
    Biometric Centre of Excellence (BCoE)
    Next Generation Identification (NGI) Program Office

Clarksburg, West Virginia, UNITED STATES OF AMERICA (14 November 2012)
  Department of Defense
    Biometric Identity Management Agency (BIMA)

New York, New York, UNITED STATES OF AMERICA (16 November 2012)
  New York Police Department (NYPD) Facial Identification Center

Ottawa, CANADA (20-21 November 2012)
  Royal Canadian Mounted Police (RCMP)
  Canadian Border Services Agency (CBSA)
  Defense Research and Development Canada (DRDC)
FELLOWSHIP REPORT METHODOLOGY

The aim of this Fellowship was, to examine emerging police use of facial recognition systems and facial image comparison procedures. A collection plan was developed to guide the collection of information in order to fulfill this aim.

At the macro level the collection plan aimed to cover:

- best practice and standards as to how to produce facial image comparison outcomes for
  - intelligence or information to support investigations (“for information/intelligence”)
  - expert forensic evidence at court (“for court”)
- best practices and standards for using facial recognition systems for real-time and post event analysis

At the micro level the collection plan aimed to cover current and planned workflow and capabilities in both the facial image comparison and facial recognition system area for each agency visited. Information was gathered in the following areas:

- Staff Roles and Expertise
- Expertise Levels
- Training and Testing Programs
- Workloads
- Laboratory and Office – Setup, Tools and Techniques
- Procedures for Facial Image Comparison
- Research Efforts and Gaps

The approach and structure for each of the eight thematic sections of this report are as follows:

- **Introduction** – provides a summary of issues covered and data gathered relevant to the topic and theme.
- **Analysis** – identifies trends and best practices of interest in terms of expertise, resources, procedures and workflows, training, as well as any specific lessons learnt or other contextual information needed to explain the data. Some sections have a distinct analysis section, whilst others incorporate the analysis as the data is described or findings.
- **Findings** – a summary of the analysis outcomes is provided in the form of primary findings. These are included to inform and assist Australian law enforcement agencies to develop forensic facial image comparison procedures and tools, and for facial recognition system use cases and performance.

It should be noted that due to the sensitive nature and security classification of police capabilities, the section on facial recognition systems of this unclassified (for public release) Churchill Fellowship report has been largely sanitised. Broad themes are discussed, but specific agency’s capabilities and use cases cannot, for security reasons, be published. This information will, however, be available and discussed within Australian and international law enforcement agencies with the relevant clearances.
SECTION ONE – OVERALL AGENCY STRUCTURES AND STAFFING

This section provides an analysis of the structure and staffing of those agencies conducting facial image comparison and using facial recognition systems. Appendix 1 contains the raw data collected, highlighting agency functions, staff structure and responsibilities.

For security reasons some of the agencies visited and/or some of their capabilities have not been discussed here. Where possible their contributions have been incorporated into this public report and more fully in a classified version for law enforcement use.

Since CAST, CBSA, and Met-M&B are involved in research and design, testing and evaluation, they do not fall into the following analysis.

For the purposes of this report the following alphabetically listed acronyms are used as reference to these agencies based upon their familiarity and necessary specificity.

CAST - Centre for Applied Science and Technology
CBSA - Canadian Border Services Agency
FBI-CJIS - Federal Bureau of Investigation; Criminal Justice Information Services; Facial Analysis Comparison and Evaluation (FACE) Services Unit
FBI-FAVIAU - Federal Bureau of Investigation; Forensic Audio, Video, and Image Analysis Unit
INP - Israeli National Police
Met-AVL - London Metropolitan Police; Audio Video Library
Met-MIB - London Metropolitan Police; Metropolitan Intelligence Bureau
Met-M&B - London Metropolitan Police; Multimedia and Biometrics
NFI - Netherlands Forensic Institute; Forensic Biometrics
NYPD-FIC - New York Police Department; Facial Identification Centre
RCMP - Royal Canadian Mounted Police; Forensic Facial Imaging Specialists

All the agencies visited organise their staff into specialist teams, typically all working together. To compare those agencies with direct operational support staff with each other, the functions of each staff member are defined here in terms of the user and consumer roles contained in the best known international attempt to define a standard terminology for such work, the Facial Identification Scientific Working Group’s (FISWG) Guidelines and Recommendations for Facial Comparison Training to Competency Version 1.1 2010.11.18 and Recommendations for a Training Program in Facial Comparison Version 1.0 2012.02.02.

The FISWG role descriptions (tasks) are presented over the page as a key to interpreting the tables and analysis presented in this section. It should be noted that not all agencies meet all the role requirements as listed under the FISWG documentation and in other cases have higher requirements.

---

FISWG Facial Recognition User and Facial Image Comparison Roles Definitions³

Manager: Sets agency policies and/or makes budget decisions.
Supervisor: Supervises and/or directs personnel engaged in the use of facial comparison methods, tools, and/or technologies.
Facial Reviewer: Evaluates one-to-many galleries either manually or with the assistance of an automated facial recognition system. This can be done either in an investigatory capacity, where there may be further information available, or in an actionable capacity, where an action may be taken based directly on this review.
Facial Examiner: Performs a rigorous one-to-one analysis, comparison and evaluation of controlled and uncontrolled images for the purpose of effecting a conclusion.
Technical Reviewer: Performs quality assurance review of the work product of facial comparison.
System Administrator: Performs the system administration required to implement, maintain, and optimise the automated facial recognition program.
Trainer: Provides instruction to others in facial comparison methods, tools, and/or technologies.
Admin/Policy⁴: General administration work including file and case management by dedicated administration staff, and any policy and development support not directly involved in comparison.

The translation for some agencies to these role descriptions is not a direct one, notably the role of facial examiner is broken down into levels of expertise by some agencies requiring different training, proven competencies and experience for different levels of examiner that are specific about whom can give evidence to court.

In addition, the manager and supervisor staff member, in some cases, can also perform the role of reviewer and/or examiner and/or trainer, i.e. one person fulfilling several of the FISWG roles.

Further, in some countries the use of facial recognition systems and facial image comparisons are done by the same area. In other countries these tasks are performed by different sections entirely, or one is not done at all. This makes the comparison across agencies more difficult, particularly in terms of demonstrating like for like capabilities between countries.

³ http://www.fiswg.org/FISWG_RecommendationsForTrainingProgram_v1.0_2012_02_02.pdf
⁴ Admin is a specific definition for this paper to cover all support work (administration to high level policy) not directly involved in operational face work; it is not a FISWG term.
Overall Structure and Staff Table

In many cases a single staff member covers multiple roles/tasks as defined by FISWG which does make the following table a little confusing the review. Where possible rather than use agency specific titles for agency staff positions, the same terms are used to help cross comparison of staff level and duties. The column titles are the FISWG role terms, where a single person has multiple roles they are listed in each relevant column. Temporary and future planned staff are listed in brackets.

Table 1: Agency Overall Staff Performing Roles/Tasks – FISWG Definitions

<table>
<thead>
<tr>
<th>AGENCY</th>
<th>Total</th>
<th>Manager</th>
<th>Supervisor</th>
<th>Facial Reviewer</th>
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</table>

| Total Staff | 79(94) | 10      | 11:12      | 48:52(67)     | 35:37(45)      | 14:15              | 6           | 10:11   |              |

*= adhoc support from other areas ()= planned total staff increases :=additional capacity (not day to day)
FR denotes operational facial recognition system is being used
Court denotes that matters are taken to court.

It can be seen from Table 1, of the 79 or so existing staff of those agencies visited and documented here, almost 66% (52) are performing the role of face reviewer (those with recognition systems), and about 47% (37) of all those visited have staff performing as facial examiners, based upon the FISWG definitions and with reference to the FISWG training document - Guidelines and Recommendations for Facial Comparison Training to Competency[5]

The task of facial review in an investigative capacity includes, but is not limited to, the use of a facial recognition system to review one-to-many galleries. For example, an officer at a booking station will conduct a one-to-many search of a controlled image against a database of controlled images. This task may also include applications involving high volume throughput. These reviewers require a basic level of training to acquire general knowledge and comprehension of the technology and major elements of the facial comparison discipline.

The task of facial examination includes, but is not limited to, a rigorous one-to-one analysis, comparison, and evaluation of controlled and uncontrolled images for the purpose of effecting a conclusion. Examiners in this situation have to draw on a larger foundation of knowledge, skill, and ability to accurately reach their conclusions. Additionally, the articulation of the scientific and legal basis for the expression of conclusions for many forensic, intelligence, or law enforcement purposes requires an even more advanced level of training to include an expanded set of knowledge, skills, and abilities above the level of basic concepts.

And these number will change when all areas come to current planned capacities for staff (94).

Face reviewers will go from almost 67% to 71% (67) as an average of all staff.

Face examiners will remain at 47% (45).

In terms of facial reviewers, the FISWG role/task definitions do not allow for distinctions of expertise or processes that exist with the role. This creates an issue where in one agency’s case the use of facial recognition systems may require only a single reviewer’s relatively quick comparison, but limited and/or undocumented facial image comparison decision to resolve a match, Met-MIB for example, and any further action to compare faces is then referred to other areas, such as Met-AVL. In other agencies facial reviewers may engage in a more time consuming, detailed, documented process for face comparison, possibly with image enhancement, done independently by two reviewers with a supervisor to adjudicate conflicting outcomes, FBI-CJIS for example. In this case, by FISWG definitions, such reviewers have also been classed as facial examiners, because they appear to meet the “rigorous” one-to-one comparison requirements outlined by FISWG. This duplication of staff through different roles/task is reflected in Table 1 for these reasons.

It should also be noted that some agencies using facial recognition systems, such as FBI-FAVIAU and the INP, may have an end result of preparing an examination “for court”, demonstrating a wide expertise and capability requirement for their staff.

For facial reviewers the trend would appear to be that they may soon also assume the role of facial examiners, as requirements for training and standards are further developed (to be discussed later in this report). There is limited knowledge at present on the best practice for the number of images that should be reviewed in a facial recognition system, the size of those images to assist human matching, and there are different levels of face comparison training for facial reviewers. For example, the United Kingdom agencies are presently putting together a new interagency facial image comparison training package for their facial reviewers which could easily see the Met-MIBs staff be reclassified as facial examiners, making the distinction between these two roles very limited when almost all FR users are then in both roles. This training will be available to other areas such as UK Border Agency.

Within the facial examiner role some agencies are conducting fairly rigorous morphological face comparisons using checklists and image enhancement tools, and then documenting findings and seeking a second independent opinion, but they are not doing so for court evidentiary purposes (FBI-CJIS, Met-MIB).

Facial examiners in other agencies and areas, such as the INP, NFI, FBI-FAVIAU and RCMP-FIS, are doing facial examination reports “for court”, which may or may not have involved the use of a facial recognition system to begin the process. These agencies have a mixture of staff expertise, where only some of them are approved to attend court even
though they may assist in examining and preparing the case. The FISWG roles do note that there will be distinctions between the training and capability of some facial examiners who need higher levels of competency, but no separate definition is given. Having met with agencies doing this work, the expertise and experience required to go to court is considered significantly different from other examiners or staff who are typically in training or a career role to aspire to more senior levels.

So whilst it has been helpful to use the FISWG roles to summarise and compare the staff capabilities of the various agencies, the issue of agency specific expertise levels is the subject of deeper analysis in Section Two – Agency Expertise Levels for Facial Image Comparison, to further draw out these issues.

Summary of Findings for Overall Agency Structure and Staffing

Given the overall view of agencies and their staffing levels, as summarised in Table 1, there are a number of key findings that arise from this analysis.

Finding 1 – Foreign Facial Recognition System Users are in Centralised, Specialised Areas Only

Of all the foreign agencies met, facial recognition systems were only used by specialised units of police and intelligence staff (including those not reported here for security reasons that use facial recognition systems specifically to support their specialised functions). There are several other police forces in the United Kingdom and United States that are known to have facial recognition systems that were not contacted as part of this Fellowship, but there is no indication that their facial recognition systems are made directly available to all officers and support staff.

In Australia, where some law enforcement agencies have had access to facial recognition systems for more than five years, system access is available with system training and minimal, if any, specific face comparison training. Facial recognition systems are largely viewed as another information or intelligence tool. The Western Australia Police do differ in this, having a specialist area within other State agencies, but overall the Australian Police model is a very different approach to the agencies visited during the Fellowship. Some Commonwealth agencies using facial recognition systems and conducting face comparisons, such as the Department of Foreign Affairs and Trade (DFAT) and the Department of Immigration and Citizenship (DIAC), do have specialised areas.

There is no specific data to suggest that either way is the best approach. On one hand immediate access to such systems without going through specialised teams (even when these specialised areas operate 24 hours/5 days or all the time 24/7) is likely to ensure such systems are used more often, which should increase the chances of a match.

But the general inference from the agencies visited is that the complexity of facial recognition system use, including image enhancement tools and skills to improve matching results and comparisons, training and mentoring, and the recognised need by those visited for team collaboration on difficult cases, is that it best sits in a specialist area undertaken by more highly trained and experienced staff. There is also the best practice of having at least one extra person also do the review (preferably independently) and a third person with expertise to manage the outcome of any conflicts. This is much easier to undertake in a team environment where staff and systems can support this workflow.

Given the training and experience requirements for some facial reviewers (week-long courses in facial image comparison) and for forensic facial examiners (often years), it may
be that the more current experience and expertise staff have (supported by appropriate time and tools) the more accurate they are likely to be. This is an assumption based on comments received and practices being undertaken.

It is likely that Australian agencies without a centralised area for running facial recognition matches would benefit from a dedicated area with appropriately trained staff, even if all staff have access. This is likely to reduce the issues of training requirements for all staff. It is also likely to reduce the issue of training decay brought about by staff not using a system due to the infrequency of need. Quality control is also much easier to maintain in a centralised group than a distributed network of users. Most importantly a dedicated area, even if it is a specific forensic area, should reduce the chance of missed and false identifications.

Finding 2 – Facial Reviewer Teams are Generally Larger than Facial Examiner Teams

Teams with day-to-day operational support facial recognition systems are significant larger than those without (those whose main focus is facial image comparison only). There is overlap but the figures are on average as follows:

For FR system using agencies (FBI-CJIS*, INP*, Met-MIB, NYPD-FIC) there are four with average team size of ~12. The team sizes range from 5 to 23 (plans for 30).

For Facial Examiner agencies (FBI-CJIS*, FBI-FAVIAU, INP*, Met-AVL, NFI, RCMP-FIS) there are size with an average team size of ~6 – or half that of the FR system users. The team sizes range for 1 to 14 (plans for 20). The two single’s are due to outsourcing of work and limited recognition of face examiner work within the structure.

It is likely the volume of requests coming through to these specialist teams, and the workflow that in many case requires comprehensive documentation and second opinions, needs to be suitably resourced. Both the FBI-CJIS and Met-MIB, for instance, are teams working shifts to cover 24/5 and 24/7 operational and background checking support requirements.

The reasons for this will be further explored in the facial image comparison workload sections of this report.

Finding 3 – Immediate Manager and Supervisors Tend to be Face Experts

It can be seen that in many cases manager and supervisors are also involved in conducting the FISWG roles of facial review, facial examination, technical review and training. The inference here is that staff directly involved in managing and supervising users of facial recognition systems and those undertaking facial examinations, should also be competent in the review and examination roles. Once again, this is why Table 1 is so complex. Many overlaps still exist even when trying to apply this standard set of definitions.

Almost without exception those more senior staff are managing teams directly, and the supervisors in the larger teams, are themselves subject matter experts undertaking the same work as their staff. These staff often have similar, or higher, expertise in the use of facial recognition systems and facial comparison work, and are also involved in the training of staff. This is always the case for areas that do or coordinate comparisons “for court” (INP, FBI-FAVIAU, Met-AVL, NFI, RCMP-FIS).
Finding 4 – Facial Reviewer Roles May or May Not Involve Facial Examination

Almost all agencies using facial recognition systems have staff that fall into both the FISWG categories of facial reviewer and facial examiner, and that is likely to grow. This, however, is not always the case. There are some agencies, including those not specifically documented here, that have staff whom are only doing facial review. They do not take the steps expected of a rigorous facial comparison. This is also the case for the Australian Federal Police and other agencies in Australia with facial recognition systems, whose staff using these systems would only be classed as facial reviewers.

What distinguishes facial reviewers from facial examiners are elements of the following:
- No examination checklist being used.
- No notes made on the reasoning for the outcome.
- No or limited training in facial comparison.
- No or limited tools to assist in image analysis and comparison.
- Not necessarily a formal secondary person’s independent opinion or supervisory oversight.
- Only a short time to review and compare faces.

To be clear, this is not to suggest that these staff are not well trained or as experienced as facial examiners (although this is likely), rather that they are, for the reasons noted above, performing the FISWG facial reviewer role as opposed to the facial examiner role.

Finding 5 – The Output of Facial Examinations May Be Used for Information/Intelligence or for the Court

The conclusion here is that there are different levels of facial examiner: those performing examinations “for information/intelligence” purposes, but still using rigorous face comparison examinations, such as FBI-CJIS; and those who are preparing reports and images “for court”, such as the INP, FBI-FAVIAU, Met-AVL, and NFI. It would seem, therefore, more useful to split the facial examiner role to recognise these different purposes, and to analyse any differences in staff expertise, training, policy and resource requirements for these roles.

This will be further addressed in the facial image comparison section of this report that follows next.
SECTION TWO – AGENCY EXPERTISE LEVELS FOR FACIAL IMAGE COMPARISON

This section provides further details and analysis of staff resources, in terms of numbers, their expertise levels and the relevant requirements they have to work at specific role levels.

Agencies Expertise and Competency Levels for Those Undertaking Facial Image Comparisons

These are the agencies conducting facial image comparison to directly support police investigations and evidence assessment by courts, from basic review to detailed comparison.

Not all the agencies that were met as part of this Fellowship are documented here due to sensitivities around national security and Defence capability issues. And those agencies doing research but not operational support are not listed either but their work will be noted elsewhere.

Not all agencies doing facial image comparisons fit a direct investigative support model. In the case of the London Metropolitan Police, Audio Video Library (MET-AVL), the capability for face comparisons “for court” is outsourced to the private sector, so the staffing is reflective of the management of this process and not the true resourcing (although this is now under review). In the case of the Netherlands Forensic Institute (NFI), the capability is for the courts where matters are tasked to them, and not for general policing support.

It should be noted that many forensics areas such as FBI-FAVIAU undertake many other sorts of comparisons besides face, such as clothing, stains and other body marks. And these skills are different again from those who forensically reconstruct faces from bones, typically forensic anthropologists, although the RCMP-FIS have expertise in this area.

As a reminder, the agency acronyms have been selected based upon ease of understanding and common usage.

- FBI-CJIS - Federal Bureau of Investigation; Criminal Justice Information Services; Facial Analysis Comparison and Evaluation Services Unit
- FBI-FAVIAU - Federal Bureau of Investigation; Forensic Audio, Video, and Image Analysis Unit
- INP - Israeli National Police
- Met-AVL - London Metropolitan Police; Audio Video Library
- Met-MIB - London Metropolitan Police; Metropolitan Intelligence Bureau
- NFI - Netherlands Forensic Institute; Forensic Biometrics
- NYPD-FIC - New York Police Department; Facial Identification Centre
- RCMP-FIS - Royal Canadian Mounted Police; Forensic Facial Imaging Specialists

This section breaks down each agencies expertise levels and requirements as they relate to performing facial examinations from the agency’s perspective. Following this is analysis to identify similarities and any important differences, and to try and map them back to FISWG terminology to put them into a comparative. Through this it is hoped to draw out key training and experience requirements that need to be considered for an Australian context.

The format used here is for each agency in alphabetical order, to provide details in the expertise in ascending order from left to right. An attempt to align columns of expertise levels with the expertise levels somewhat arbitrarily assigned to columns labeled with generic
terms to form a scale of Foundation, Advanced and Expert. Three levels were chosen purely because that is the most any agency presently has.

These tables are about relativity of expertise levels, and it should be clear no knowledge exists or attempt has occurred to actually compare the expertise or accuracy of these different agencies staff to perform these duties in relation to one another.

So for a little more definition about these three somewhat arbitrary divisions:

- **Foundation** means can perform face comparisons after introductory or basic training likely only for review purposes or as a trainee to advance to other levels.
- **Advanced** means maybe comparing them for review or forensic outcomes. If entry level likely has professional expertise and/or studies requirements.
- **Expert** is the highest agency recognized level of expertise and is only for those who are capable of taking matters to court.

Under these titles are details on the number of staff performing the role (and in brackets an additional numbers planned), and then information on the role’s duties, and a fourth section on the requirements and prerequisites for the position.

<table>
<thead>
<tr>
<th>Assessed Level</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency</td>
<td>Position Title 1</td>
<td>Position Title 2</td>
<td>Position Title 3</td>
</tr>
<tr>
<td>Number of Staff</td>
<td># (# planned)</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>Roles/Duties</td>
<td>Description</td>
<td>Description</td>
<td>Description – Court Requirement</td>
</tr>
<tr>
<td>Requirements</td>
<td>Description</td>
<td>Description</td>
<td>Description</td>
</tr>
</tbody>
</table>

**Face comparisons since – date**

**For Court or For Information (Intelligence)**

**Table 2: Expertise Levels - FBI CJIS Facial Analysis Comparison and Evaluation (FACE) Services Unit.**

<table>
<thead>
<tr>
<th>Assessed Level</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBI-CJIS</td>
<td>Biometric Image Specialist</td>
<td>Supervisory Biometric Image Specialist</td>
<td>NIL COURT</td>
</tr>
<tr>
<td>Number of Staff</td>
<td>11(17)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Roles/Duties</td>
<td>Responsible for conducting facial recognition checks and facial image comparisons.</td>
<td>Responsible for resolving facial image comparison conflicts. Staff leadership</td>
<td></td>
</tr>
</tbody>
</table>
| Requirements | - No prerequisites.  
- (Many staff have been fingerprint examiners)  
- FBI weeklong facial comparison and identification training course.  
- Photoshop for FBI course.  
- 15 hours of development training a year.  
- Some court training (staff do not attend court at present)  
- Plans for age regression/progression course. | - Experienced Biometric Image Specialist.  
- Supervisory Skills  
- FBI weeklong facial comparison and identification training course.  
- Photoshop for FBI course.  
- 15 hours of development training a year.  
- Some court training (staff do not attend court at present)  
- Plans for age regression/progression course. | |
Table 3: Expertise Levels - FBI Forensic Audio, Video, and Image Analysis Unit (FAVIAU).

<table>
<thead>
<tr>
<th>Assessed Level</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBI-FAVIAU</td>
<td>Forensic Examiner / Photographic Technologist</td>
<td>Forensic Examiner / Photographic Technologist Senior Scientists (2)</td>
<td></td>
</tr>
<tr>
<td>Number of Staff</td>
<td>2 (in training)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Roles/Duties</td>
<td>Responsible for facial comparisons, video and image analysis including digital source analysis</td>
<td>Responsible for facial comparisons, video and image analysis including digital source analysis</td>
<td></td>
</tr>
<tr>
<td>Requirements</td>
<td>• Undergraduate degree, preferably in mathematics, engineering, physical sciences or photographic related. • FBI FAVIAU Facial Comparison and Identification Course. • Nominal 2-year training period.</td>
<td>• Complete training program which includes multiple competency tests and several moot courts prior to certification to be “qualified”. • Postgraduate degree desired. • Leading role in development in field including publishing scientific peer reviewed papers. • Conduct training.</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Expertise Levels - Israeli National Police (INP) – Criminal Album Unit.

<table>
<thead>
<tr>
<th>Assessed Level</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>INP</td>
<td>Examiner</td>
<td>Expert</td>
<td>Senior Expert</td>
</tr>
<tr>
<td>Number of Staff*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Roles/Duties</td>
<td>Facial Image Comparisons</td>
<td>Facial Image Comparisons (for court)</td>
<td>Facial Image Comparisons (for court) Policy and research International liaison Teaching</td>
</tr>
<tr>
<td>Facial Recognition System Use</td>
<td>Facial Recognition System Use Policy and research International liaison Teaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requirements</td>
<td>• Undergraduate degree in a relevant area and/or relevant experience. • Lab worker 3 week administrative and technical training. • Training: Photoshop course including image enhancements; forensic photography training. • On the job FR system training. • On the job experience with morphological face comparison.</td>
<td>• Undergraduate degree in a relevant area. • 2 years as an examiner and/or conducted 100 digital evidence cases (including face/body comparison and other digital evidence cases). • Attend court to see expert witness present at least 4 times. • Expert Witness workshops or mock court simulation. • Training: Facial Anatomy. • Concept of FR system knowledge.</td>
<td>• 4 years as an Expert. • Presented evidence on face to court at least once. • Establishing comparison standards and best practices. • Knowledge in all primary case studies of key cases • Wider knowledge of facial anatomy including aging, ethnic groups, plastic surgery and morphological difference between identical twins. • Understanding other methods of face comparison. • Basic understanding of image authenticity. • Understanding of basic statistics and probabilities.</td>
</tr>
</tbody>
</table>

*This is the currently proposed staff restructure and training requirements for new staff.
Table 5: Expertise Levels - London Metropolitan Police – Audio Video Library (AVL).

<table>
<thead>
<tr>
<th>Assessed Level</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met-AVL</td>
<td>Senior Digital Forensic Practitioner</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Staff*</th>
<th>1*</th>
</tr>
</thead>
</table>

| Roles/Duties | Face Comparison (quality assurance of outsourced face comparisons) Image and video analysis. |

| Requirements | • Undergraduate degree * Post graduate preferred • Video and image analysis training. • Photoshop training. • Court training. • (Has a postgraduate forensic anthropology background.) |

*AVL outsources facial image comparisons to the private sector so human resources are higher than they appear here. Private sector facial comparison in the United Kingdom is not regulated and does not have any certification standards, so comparison reports quality vary significantly.

Table 6: Expertise Levels - London Metropolitan Police – Metropolitan Intelligence Bureau (MIB).

<table>
<thead>
<tr>
<th>Assessed Level</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met-MiB</td>
<td>Intelligence Officer</td>
<td>NIL COURT</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Staff</th>
<th>23</th>
</tr>
</thead>
</table>

| Roles/Duties | Facial recognition. Facial Comparison (For information only). |

| Requirements | • No prerequisites. • Trained in FR system use and Corel Paintshop Pro for image enhancement. • Formal UK training course planned – to have wide variety of elements including court training. |
## Table 7: Expertise Levels - Netherlands Forensic Institute (NFI) - Image Analysis and Biometrics.

<table>
<thead>
<tr>
<th>Assessed Level</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFI</td>
<td>“Team Member”</td>
<td></td>
<td>“Expert FIC”</td>
</tr>
<tr>
<td><strong>Number of Staff</strong></td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Roles/Duties</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imaging analysis.</td>
<td>Facial Image Comparisons</td>
<td>Policy and research</td>
<td></td>
</tr>
<tr>
<td>Facial Image Comparisons</td>
<td>Specialty field such as codecs, photogrammetry etc.</td>
<td>International liaison</td>
<td></td>
</tr>
<tr>
<td>Specialty field such as codecs, photogrammetry etc.</td>
<td>Policy and research</td>
<td>Teaching</td>
<td></td>
</tr>
<tr>
<td>Policy and research</td>
<td>International liaison</td>
<td>Approve (sign) specialty</td>
<td></td>
</tr>
<tr>
<td>International liaison</td>
<td>Teaching</td>
<td>Examination Report.</td>
<td></td>
</tr>
<tr>
<td>Teaching</td>
<td>Approve (sign)</td>
<td>Facial Image Examination Report.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Undergraduate degree or similar relevant experience.</td>
<td>• Undergraduate degree or similar relevant experience.</td>
<td>• Undergraduate degree or similar relevant experience.</td>
<td></td>
</tr>
<tr>
<td>• NFI ‘on the job’ training for face comparison.</td>
<td>• NFI ‘on the job’ training for face comparison.</td>
<td>• NFI ‘on the job’ training for face comparison.</td>
<td></td>
</tr>
<tr>
<td>• Expert in imaging analysis (including Photoshop) that includes 1:1 for face.</td>
<td>• Expert in imaging analysis (including Photoshop) that includes 1:1 for face.</td>
<td>• Expert in imaging analysis (including Photoshop) that includes 1:1 for face.</td>
<td></td>
</tr>
<tr>
<td>• A variety of 1 day courses including quality control, justice, law, court case study reviews, process management, communication, Bayesian analysis and statistics (2), writing NFI reports, criminalistics (2), presenting data, advocacy training.</td>
<td>• A variety of 1 day courses including quality control, justice, law, court case study reviews, process management, communication, Bayesian analysis and statistics (2), writing NFI reports, criminalistics (2), presenting data, advocacy training.</td>
<td>• A variety of 1 day courses including quality control, justice, law, court case study reviews, process management, communication, Bayesian analysis and statistics (2), writing NFI reports, criminalistics (2), presenting data, advocacy training.</td>
<td></td>
</tr>
<tr>
<td>• Visiting different forensic areas.</td>
<td>• Visiting different forensic areas.</td>
<td>• Visiting different forensic areas.</td>
<td></td>
</tr>
<tr>
<td>• Court training and assessed exam on two reports (with real judge, legal and scientists)</td>
<td>• Court training and assessed exam on two reports (with real judge, legal and scientists)</td>
<td>• Court training and assessed exam on two reports (with real judge, legal and scientists)</td>
<td></td>
</tr>
<tr>
<td>• 6 specialty reports tested including presentation to Chief Scientist and external Judge and subject Matter Expert, including exam. Reexamined every 4 years on 4 reports.</td>
<td>• 6 specialty reports tested including presentation to Chief Scientist and external Judge and subject Matter Expert, including exam. Reexamined every 4 years on 4 reports.</td>
<td>• 6 specialty reports tested including presentation to Chief Scientist and external Judge and subject Matter Expert, including exam. Reexamined every 4 years on 4 reports.</td>
<td></td>
</tr>
</tbody>
</table>
Table 8: Expertise Levels - New York Police Department (NYPD) Facial Identification Centre (FIC).

<table>
<thead>
<tr>
<th>Assessed Level</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYPD-FIC</td>
<td>&quot;Staff&quot;</td>
<td>Sergeant</td>
<td>NIL COURT</td>
</tr>
<tr>
<td>Number of Staff</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Requirements</td>
<td>• All staff have a background in imagery. • Adobe Photoshop training. • Final Cut Pro (video software) training. • Plans to do FBI weeklong face comparison training course.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9: Expertise Levels - Royal Canadian Mounted Police (RCMP) Forensic Facial Imaging Specialist.

<table>
<thead>
<tr>
<th>Assessed Level</th>
<th>Foundation</th>
<th>Advanced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCMP-FIS</td>
<td>Forensic Facial Imaging Specialist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Staff</td>
<td></td>
<td></td>
<td>1:2* **</td>
</tr>
<tr>
<td>Roles/Duties</td>
<td>Facial image comparison “for information/intelligence” and “for court”. Training in facial image comparison.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requirements</td>
<td>No formal training or certification. (Has 26 years as forensic artist and 10+ years experience facial comparisons)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The East Coast Forensic Facial Imaging Specialist and the Analyst at the National Center for Missing Persons and Unidentified Human Remains are involved in facial comparison in the RCMP.
** There are other non-RCMP Forensic Facial Imaging Specialists who are also involved in facial comparisons and verifications, they are with the Ontario Provincial Police (OPP) and the Royal Newfoundland Constabulary (RNC)
Analysis of Agency Staff Expertise Levels

Staff Role Outcomes

All agencies discussed in this section are conducting facial reviews and facial comparisons “for information/intelligence” to assist in investigations and/or “for court”. Table 10 below outlines which agencies are performing which of these functions.

Table 10: Reasons for Facial Review and/or Facial Comparison by Agency

<table>
<thead>
<tr>
<th>Agency</th>
<th>For Information</th>
<th>For Court</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBI-CJIS</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>FBI-FAVIAU</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>INP</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Met-AVL</td>
<td>(Yes)</td>
<td></td>
</tr>
<tr>
<td>Met-MIB</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>NFI</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>NYPD-FIC</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>RCMP</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Number of Years Undertaking Facial Image Comparisons

Those agencies undertaking matters “for court” have, for the most part (Met-MIB being the exception), been doing so for much longer than newer areas that are principally focused around facial recognition systems (highlighted in green in the table below). The FBI, INP and NFI have been undertaking comparisons for significantly longer than other agencies, and doing so “for court” as well. The number of years is approximately to the end of 2012.

Table 11: Number of Years Undertaking Facial Image Comparisons

<table>
<thead>
<tr>
<th>Agency</th>
<th>Year Started FIC</th>
<th>Number of Years</th>
<th>For Court</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBI-CJIS</td>
<td>2011</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>FBI-FAVIAU</td>
<td>~1960</td>
<td>~50</td>
<td>Yes</td>
</tr>
<tr>
<td>INP</td>
<td>1990</td>
<td>22</td>
<td>Yes</td>
</tr>
<tr>
<td>Met-AVL</td>
<td>2007</td>
<td>5</td>
<td>(Yes)</td>
</tr>
<tr>
<td>Met-MIB</td>
<td>2003</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>NFI</td>
<td>~1990</td>
<td>~22</td>
<td>Yes</td>
</tr>
<tr>
<td>NYPD-FIC</td>
<td>2011</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>RCMP</td>
<td>2002*</td>
<td>10* (approx.)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Expertise Level Requirements

Across all agencies, for roles performing facial image comparison “for information/intelligence” purposes only, there are no specific prerequisite standard skills required, although there is a clear preference for imaging (Adobe Photoshop etc.) experience by some agencies.

For roles performing facial image comparison “for court”, however, there is a requirement for a relevant educational background and/or experience, although this varies across agencies. Within these agencies there are very specific, and extensive, training and experience (measured in years) requirements for advancement to higher levels, which in some cases includes testing and regular review.
These training requirements will be analysed further in the training section of this paper due to their variation.

Of note, there are no recognised national or international certification processes for facial image comparison, so any testing that is conducted is internal, agency-specific only.

There are no obvious or clear external training courses that are being undertaken by law enforcement, except for the USA where the week-long FBI Face Comparison and Identification Course is regarded as a course of choice by agencies there.

**Number of Staff Expertise Levels**

For agencies dealing with matters “for information/intelligence”, a single level of expertise is typical, with a supervisory and/or peer review best practice approach adopted – but there is no facial comparison higher level of review.

For agencies undertaking forensic facial image comparisons (i.e. “for court”) there is a clear recognition of levels of expertise, in most cases. Furthermore, for most, the lower expertise level(s) do not have approval to present evidence to court, but may be involved in preparing the materials and providing an internal opinion on the matter.

**Table 12: Number of Staff Expertise Levels**

<table>
<thead>
<tr>
<th>Agency</th>
<th>Expertise Levels</th>
<th>For Court</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBI-CJIS</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>FBI-FAVIAU</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>INP</td>
<td>3</td>
<td>Yes</td>
</tr>
<tr>
<td>Met-AVL</td>
<td>1*</td>
<td>(Yes)</td>
</tr>
<tr>
<td>Met-MIB</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NFI</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>NYPD-FIC</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>RCMP</td>
<td>1*</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* Specialist staff working singularly

**Staff Expertise Levels and Staff Numbers**

To revisit the FISWG definitions, those performing roles “for information/intelligence” may fall into both the facial reviewer and facial examiner roles. There is, however, a hard division possible within the facial examiner role to split those who actually can attend court from those who cannot. Creating a new role, forensic facial examination for these court qualified/attending staff is easily done, leading to these modified and new role/functions. The proposed changes to the FISWG definitions are presented below (new information in italics).

**Facial Reviewer:** Evaluates one-to-many galleries either manually or with the assistance of an automated facial recognition system. *One-to-one comparisons are done but no or limited notes are made, typically with limited time. Performed for information and intelligence purposes to support investigations.*

**Facial Examiner:** Performs a rigorous one-to-one analysis, comparison and evaluation of controlled and uncontrolled images for the purpose of effecting a conclusion. *Time and tools are available to perform this task, and best practice is to also have an independent secondary opinion performed. Performed for information and intelligence purposes to support investigations. May also include using facial recognition systems (facial reviewer role) and preparing matters for Forensic Facial*
Examiners.

**Forensic Facial Examiner:** Performs a rigorous one-to-one analysis, comparison and evaluation of controlled and uncontrolled images for the purpose of effecting a forensic conclusion. Qualified and permitted by agency to perform examinations of faces for court. Time and tools are available to perform these tasks. May also include using facial recognition systems (facial reviewer role).

It would also be possible to split the facial examiner roles into those who use facial recognition systems and those who do not, to try and create a separate generic job title rather than roles. This would be particularly useful for those who do this work as part of further analysis or processing, but do not themselves use a facial recognition system. The abilities, expertise or training issues required to search a gallery for potential matches were not expressed in any consistent way between agencies. This is an area of obvious research interest, but for the purposes of this report such a breakdown has limited value.

The following table presents a summary of staff numbers and roles by agency, using the proposed role definitions presented above.

**Table 13: Agency Staff in Facial Roles/Tasks**

<table>
<thead>
<tr>
<th>AGENCY</th>
<th>Total Staff</th>
<th>FR/FE</th>
<th>Facial Reviewer</th>
<th>Facial Examiner</th>
<th>Forensic Facial Examiner</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBI-CJIS</td>
<td>14(20)</td>
<td>14(20)</td>
<td>14(20)</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>FBI-FAVIAU</td>
<td>5(7)</td>
<td>5(7)</td>
<td>5(7)</td>
<td>5(7)</td>
<td>5(7)</td>
</tr>
<tr>
<td>INP</td>
<td>5:6</td>
<td>1:5</td>
<td>4:5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Met-AVL</td>
<td>1:2</td>
<td>-</td>
<td>1:2</td>
<td>5</td>
<td>(1* quality assurance)</td>
</tr>
<tr>
<td>Met-MIB</td>
<td>23(30)</td>
<td>23(30)</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>NFI</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>NYPD-FIC</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>RCMP-FIS</td>
<td>1*</td>
<td>-</td>
<td>1*</td>
<td>1*</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>59:61(76)</strong></td>
<td><strong>48:52(67)</strong></td>
<td><strong>35:37(45)</strong></td>
<td><strong>13(16)</strong></td>
<td></td>
</tr>
<tr>
<td>FR + FE</td>
<td></td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

() = includes additional staff who are in training # equals excess capacity from another section. Shading highlights staff doing reviews and examinations as part of the same job.

**Summary of Findings for Agency Expertise Levels for Facial Image Comparison**

Given the variability in resourcing, expertise levels and requirements to work at specific role levels between the various agencies there are a number of key findings, presented below.

**Finding 6 – 21% of all Agencies Face Staff do Forensic Facial Image Comparisons**

Of the 79 (Table 1) or so existing staff of those agencies visited and documented here, 77% (61) are directly involved in some form of face comparison. In the future it will be more like 80% (76 of the 94 from Table 1). The rest are management, policy, as well as in administration and support roles. Some agencies like the FBI-FAVIAU, INP, NFI, NYPD-FIC, RCMP-FIS have almost all their team/units staff undertaking reviews and comparisons. Almost 65% (52) of all staff perform facial reviewer roles (those agencies with facial recognition systems), and about 46% (37) of all those visited have staff performing the role of facial examiner. The difference largely comes from the Met-MIB who at present only
undertake facial reviews. Approximately 35% of staff (29) performing both of these roles. Should the Met-MIB shift to examiner types roles that figure would more than double back to the 65%.

Of all staff approximately 17% (13 from 79) are undertaking forensic facial image comparisons for court purposes. Of those agency staff undertaking face work 21% (13 from 61) are doing it for court. Looking at this as a subset of those classed as facial examiners, about 35% (13 from 37) need to go to court at present. Since undertaking this Fellowship the Met-AVL are looking at doing face comparisons in house again which should bump these figures up.

The INP are the only group undertaking on a regular operational police basis all these roles. FBI-FAVIAU do support work and special projects but do not do daily support for operations using facial recognition. On a country by country basis, and based only on those agencies met, Israel, the UK (Met-MIB/AVL), and USA (FBI CJIS/FAVIAU) are all doing the different roles across multiple teams, but Israel is the only one doing all three roles defined here within the single unit.

This will be discussed further in Section Four – Facial Image Comparison Workload in this report.

Finding 7 – Forensic Face Areas Have Multiple Expertise Levels and Longer Professional Development Requirements

Those agencies undertaking matters “for court”, for the main part, are more established. Having this responsibility requires professional advancement through multiple expertise levels before being permitted to present at court. This is perhaps best demonstrated by the INP that shows a progression for police officers and analysts to become forensic examiners over years, with various training and testing requirements. The NFI and FBI-FAVIAU only have two levels or expertise, not three, but their minimum requirements for entry require an undergraduate and likely postgraduate relevant university qualification. The NFI and FBI-FAVIAU are also not as closely involved in day to day police support work, being areas of forensic expertise for support to court, as well as for technical research and design work.

Finding 8 – There is an Expectation That All Facial Image Comparisons Could Go to Court and Special Training Is Required for Court

Those agencies operating facial recognition systems “for information/intelligence” outcomes all expressed views that the future of such system use could involve staff having to give evidence in court. This evidence would not necessarily be as an expert witness. Because of this there is a consistent view amongst agencies that facial image comparison procedures and training, for what is presently non-court intended facial comparison roles, need to be developed or adapted to meet this requirement.

If this does eventuate it is likely that all agencies with a single face comparison expertise staff level at present will need to consider at least a second level of higher expertise with the same sorts of requirements that can be seen for the FBI-FAVIAU, INP, and NFI.

The issue of training will be discussed further in Section Three – Agency Facial Image Comparison Training Programs.
SECTION THREE – AGENCY FACIAL IMAGE COMPARISON TRAINING PROGRAMS

For facial image comparison work agencies have a wide range of training requirements to perform their work, to attend court, and to advance to higher expertise levels (where available). In Section Two – Agency Expertise Levels for Facial Image Comparison, these courses and requirements were identified, and they will be further analysed here in a summary form to identify useful components to be considered in Australia.

Agency Prerequisites

To be part of these facial examiner areas, some agencies do have a prerequisite of some form of image analysis and video skills and experience. FBI-FAVIAU, INP, Met-AVL, and NFI require an undergraduate university degree (or equivalent experience in a relevant field). INP requires a degree in Applied Photography and Digital Media and/or Bio-anthropology or related field. The Met-AVL requires staff to have been working two years in the area of video analysis. Postgraduate degrees are also common for many staff in these agencies.

Staff in the FBI-FAVIAU, INP, Met-AVL, NFI, and NYPD-FIC FIC all have some background in these areas at the entry level. Indeed INP, Met-AVL, NFI and FBI-FAVIAU staff continue to do image and video analysis work as part of their duties, specialising in some cases in particular analysis areas like Photo Response Non-Uniformity (PRNU).

Facial Image Comparison Courses and Training

When looking at courses and training, there is a division on the training for those who perform a facial examination role (“for information/intelligence”), compared with those who perform a forensic facial examination role (“for court”).

Facial Reviewer and Examiner (FBI-CJIS, Met-MIB, NYPD-FIC):

All agencies have some form of training and the trend across agencies is for a minimum that provides for:

- Facial examiner training - typically a combination of course(s) (which may take several weeks and be delivered in modules), covering the basics of image analysis, along with mentoring.
- Adobe Photoshop competency - to allow for facial image comparisons. Sometimes other software products with similar functionality.
- Video analysis education - sometimes required to be able to at least extract, but possibly forensically recover, facial images and other evidence, which includes knowledge of codecs, video player software and related camera optical issues.
- Awareness of facial recognition system basics - usually required.
- Procedural and process management.

Forensic Facial Examiner (FBI-FAVIAU, INP, Met-AVL, NFI and RCMP)

Agencies preparing and presenting evidence to courts have much longer and more extensive training requirements. In many cases these include testing which will be discussed further following this. Typically the minimum time to become a forensic facial examiner is two years (INP has a four year requirement planned). Involvement in a number of real cases is also a key requirement to achieve and maintain this level of expertise.
Training typically includes:

- Advanced facial comparison training and knowledge - comparison history and current practices, issues of aging, comparing twins, deliberate alterations such as makeup and surgery, ethnic group differences etc.
- Forensic photography training - 2 weeks or more.
- Forensic image analysis and enhancement.
- Forensic video editing, analysis and enhancement.
- Expert witness/court/law training - history of image comparisons at court, case law, admissibility, and including court attendance to see forensic evidence given, including testifying training such as mock courts with real lawyers and judges in some cases.
- Knowledge and exposure to forensic science and to other disciplines involved in human comparisons, including issues around bias and human error, research methodologies, empirical evidence, peer review and repeatability for validity.
- Understanding of statistics and Bayesian probabilities.
- Detailed (facial) anatomy course and required reading materials.
- Knowledge (and experience) with facial recognition systems - understanding of biometrics versus forensics.
- Many agencies have on the job experience with close supervision and mentoring requirements.

Other education and experience requirements, and key duties for the supervisory/management levels include:

- Knowledge of primary facial comparison cases studies and the relevant laws for evidence and comparisons.
- Actual experience giving evidence on facial comparisons in court.
- Developing the facial comparison field and publishing peer reviewer research papers to address research gaps.
- Regular international liaison with international experts to support the development of best practices, facial comparisons standards and to increase knowledge of case studies and research being done.

One interesting finding from these consolidated agency training requirements is that they are closely aligned with the requirements proposed by the FBI in 2009, in a paper entitled *Facial Comparisons by Subject Matter Experts: Their Role in Biometrics and Training*. That paper proposed that training should cover:

**General Knowledge**

- History of personal identification and comparison science.
- Biometrics advances – facial recognition systems.
- Underlying principles – photographic comparison, ACE-V, individuality and comparison science.
- Image science – photography.
- Image processing – also commonly called image analysis.

**Facial Specifics**

- Properties of the face – anatomy, aging, expression, damage.
- Alterations of the face – including image manipulation.

**Legal Issues** – case law, admissibility and advocacy.

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The other distinction this paper made was that there are two types of examiners. Standardized Image Examiners (SIE) and Uncontrolled Image Examiners (UIE). SIE’s work only with images taken under controlled conditions to standards such as passport, visa and charge photos. UIE’s would do those and everything else, and the paper makes the claim that UIE’s will require a much higher level of knowledge and expertise. Every agency visited in this Fellowship would fall into the UIE definition, with everyone having to deal with CCTV and other lower quality and degraded imagery from crime scenes and investigations.

**Facial Image Comparison Courses of Note**

There are some courses that might be available to others and could also be a model for work being done in Australia. This is not an exhaustive list as all agencies have some sort of training program, but these are the ones that are in English and more likely to be available to Australian government agencies prepared to travel (note: the US Department of Defense training programs are not discussed here).

**NFI**

Have a three-day image processing and analysis introduction including FIC they run for international examiners, available to other government agencies undertaking forensic work. It is held in The Hague, conducted in in English around about May each year.

**FBI Facial Comparison and Identification Training Course**

The FBI *Facial Comparison and Identification Training* course, which is a week in length and taught by staff at FBI-FAVIAU. Prerequisite requirements to undertake this course include Adobe Photoshop training.

This FBI-FAVIAU course has been undertaken by US agencies CJIS and the NYPD indicated an interest in completing it. It has also been undertaken by international police staff including Met-MIB and various Australian agencies not covered in this report (including the Australian Federal Police).

It is understood that an advanced version of this course is now under consideration by FBI-FAVIAU with support and assistance of the FBI’s Biometric Centre of Excellence (BCoE).

**United Kingdom**

The UK government, including the Home Office CAST, Passport Service, Border Force, and the London Metropolitan Police, are presently compiling a set of materials to form a training package for facial image comparison. It is a modular training package that will initially cover high quality facial image comparisons, with later modules covering poorer quality charge/booking (mug shot) photos down to CCTV level. The aim of the package is to provide practical examples in demonstration of techniques etc.

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7 ibid
RCMP
In 2008, at the request of surveillance teams, RCMP created a two-day training course to assist police officers involved in surveillance to improve their ability to identify their targeted subjects. The training exposed the officers to basic facial anatomy and strategies on how to recognise facial elements that make individuals unique. This training has been delivered on a few occasions with good results; officers performing better in the field and, therefore, reducing the risk of mistaken identity.

Facial Image Comparison Testing and Certification

Again there appears to be a distinction regarding testing between those agencies with a forensic focus and those not.

With the exception of one agency not specifically mentioned here due to security reasons that would be classed as not doing forensic facial comparison, at present FBI-CJIS, INP, Met-MIB, and NYPD-FIC do not have testing or certification requirements.

Forensic facial examiners in other agencies such as FBI-FAVIAU, Met-AVL, NFI and RCMP, for the most part where a team exists, do have testing of staff post-training and to achieve and maintain expertise levels.

Some agency’s training and certification highlights include:

• The FBI-FAVIAU requires
  o 2 year training program with multiple competency tests and 4-5 moot courts prior to internal “certification” (which is referred to as “qualification”).
  o After being qualified, one must be tested annually as part of their laboratory ISO 17025 certification.

• The INP planned training for new staff will require
  o Higher level expertise requires analyses for face and body comparison, 100 of all types, but notably focused on faces and bodies, to then complete their training.
  o Court expert witness simulation workshops or mock court simulations.

• The NFI training requires
  o To certify as an expert, 10-20 cases must be completed.
  o Mock court examination on two reports, with real judges and lawyers, and senior scientists.
  o For an authorised expert certified to sign exams, this includes producing six reports for which each is presented briefly and then evaluated by training staff, chief scientist and external judges and prosecutors as well as other subject matter experts.
  o Every exam is graded and a certificate given.
  o Every four years staff must be re-examined for 4 reports.
Summary of Findings for Agency Facial Image Comparison Training Programs

There is a range of training-related findings relevant to Australian government agencies, presented below.

Finding 9 – Adobe Photoshop Training is the Default Requirement for Most Agencies

The basic software tool for all image enhancement and image comparisons by most agencies is Adobe Photoshop Creative Suite. Some agencies use other (cheaper/free) software for the same purpose. The large majority of those doing more advanced face comparisons though are using Adobe Photoshop for comparisons. This is a requirement of the FBI Facial Comparison and Identification course for example. All forensic areas use Adobe Photoshop.

It is understood that Adobe Photoshop is used because it is a well understood, publically available and court accepted software tool that allows trackable and repeatable steps to enhance and markup images to assist the court.

Finding 10 – Training is Required to Support Analysis of Crime Scene Video

All agencies met with deal, on a regular basis, with crime scene video that contains faces of suspects. This requires staff to have at least an awareness of the media itself. Most countries though have agencies that require their staff to have knowledge, skills and tools to find and extract these faces for comparison, as well as to use facial recognition systems. FBI-FAVIAU, INP, Met-AVL, and NFI are experts at forensic examination of video, conducting ongoing research to support investigations as well as “for court”.

Those undertaking comparisons “for court”, for the most part, have areas of high expertise in image and, in many cases, video analysis, which includes a working knowledge of key image software such as Apple Inc’s Final Cut Pro and Avid.

Finding 11 – Examiners Require Forensic Photography and Image/Video Analysis Skills For Uncontrolled Imagery

Another common area of expertise for forensic facial examiners is a working knowledge of forensic photography, and understanding of the different types of images and their metadata due to the wide range of image qualities and formats they receive.

Many of those involved in more advanced facial comparisons come from a background, or have extensive training and experience in, imaging and forensic photography. This gives them an understanding of imaging conditions, such as optical distortion, illumination issues, perspective, motion blur, dynamic range, sensor size and resolution issues, in camera and post-capture compression and recompression issues, types and cause of image artefacts etc.

Many also have a good understanding of and/or training in image analysis. Indeed it is almost mandatory across forensic areas. This also extends to video/CCTV issues for most police forensic areas. Such training includes how to use tools like Adobe Photoshop to understand images, and to adjust settings and use filters. It also includes a basic awareness of other tools available to enhance details in images and video, and how this is done, even if this is a role performed by a separate area of the agency.
This finding supports Nicole Spaun (formerly FBI-FAVIAU) that there are two types of examiners, Standardized Image Examiners (SIE) that deal with passport, visa and driver license type controlled imagery for comparison, and police, criminal forensics and defence who must manage everything which she labeled, Uncontrolled Image Examiners (UIE).

**Finding 12 – Forensic Facial Examiners Require Specialised Training**

Whilst both forensic and non-forensic facial examiners have access to a wide range of training, forensic facial examiners are generally required to have a relevant undergraduate degree and extensive training and experience undertaking facial image comparisons before they go to court. In addition, it is common practice to be tested and retested to both achieve and maintain a higher level of expertise, as well as to be able to attend court.

These distinctions demonstrate a very high resourcing requirement for agencies with forensic facial examiners:

- Appropriate staff (likely requiring a relevant undergraduate degree or to acquire during training).
- Experience mentoring staff with time and resources to train and closely supervise staff along with their other work commitments.
- Training course(s) to cover all the areas of expertise needed for a forensic facial examiner.
- Standard terms (anatomy etc.) and required study materials to train staff and for reference in facial anatomy and to standardise forensic techniques.
- Other associated training support related to court training, e.g. mock courts with expert teachers and role players, and time to see others give such evidence.
- Equipment (Adobe Photoshop, video software, different quality and types of cameras, scanners, appropriately powerful computers etc.)

In addition, time is needed to:

- Practice and understand the performance of facial recognition systems, along with understanding of processes and results from peak biometrics testing such as the USA’s National Institute of Standards (NIST) Facial Recognition Vendor Tests (FRVT) results.
- Adequately prepare staff “for court” (often measured in years).
- Run testing and certification / recertification processes.
- Enable team leaders and senior staff to be involved in conducting research and development to further develop facial image comparison procedures, standards and tools, including involvement with national and international peers to better and more quickly develop these (e.g. involvement in FISWG bi-annual meetings).

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SECTION FOUR – FACIAL IMAGE COMPARISON WORKLOAD

Facial image comparison workloads vary significantly across agencies. Not surprisingly, those conducting facial reviewer and facial examiner work undertake many more reviews by an order or two of significance, than do those conducting forensic facial examiner work. A measurement of a few to tens of minutes for non-forensic work for one to three staff, shifts to many hours or days for forensic work, as these may involve the whole team for complicated cases.

In many respects this is what was described by Spaun as Standardized Image Examiners (SIE) and Uncontrolled Image Examiners (UIE) but there is also a separate consideration of the outcome for information/intelligence or “for court” the later which adds considerably to the time and resources needed to complete. General examples of the two extremes of facial image comparison are presented below.

Simple facial image comparison example: a single officer or analyst may be provided, electronically, with a good quality facial image to see if there is a match in a facial recognition system “for information/intelligence” purposes only. This would typically take only a few minutes (even with an independent second opinion) with little administrative overhead as the outcome is just “for information/intelligence”.

Complex facial image comparison example: several poor quality still images and video segments of a suspect in a major crime are required for review, including images on seized exhibits from suspects, with the added complexity of several years between images, which may take hours or days to forensically recover, transcode to useful formats, and then compare (often involving the entire team independently at first and then as a whole). This is all done whilst preserving the originals and tracking and documenting all steps in the analysis, which can include conflicts between team member opinions and reasoning. The comparison report would then be finalised and approved, which could include many images with enhancements and highlights to assist understanding by the prosecution and, later, presentation to the court. Staff may possibly be called to court to testify. The time measurement here is not in minutes, but in days for the comparison report alone, will involve potentially several staff, and additional days for the court preparation and presentation elements.

In all cases there is also a varying amount of administration to accept and lodge materials for comparison, which can also include analysis of images and data via facial recognition systems. Where video is involved this becomes more complex and time consuming with propriety video formats and extraction issues. Typically most agencies create hard copy files that include printouts of images as well as the forms used to process and track the exhibits and working copies (and all enhancements, extractions and markups undertaken).

Agencies were asked to give statistics, where available, but to also provide an indicative average workload cost in hours to give a rough estimate of resources required for each case.

9 ibid
Agency Facial Image Comparison Workload Statistics

The following table provides an approximation of the indicative staff numbers assigned to the different facial image comparison areas for 2011/12.

Table 14: Agency Facial Image Comparison Workload Statistics 2011 and 2012

<table>
<thead>
<tr>
<th>AGENCY</th>
<th>FiC Staff</th>
<th>For Information/Intelligence</th>
<th>For Court (Forensic)</th>
<th>Attend Court</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBI-CJIS</td>
<td>14(20)</td>
<td>-</td>
<td>15010 (~1 year)</td>
<td>-</td>
</tr>
<tr>
<td>FBI-FAVIAU*</td>
<td>5(7)</td>
<td>~25-50</td>
<td>~25-50</td>
<td>~50-100</td>
</tr>
<tr>
<td>INP</td>
<td>4.5</td>
<td>-</td>
<td>-</td>
<td>n/p</td>
</tr>
<tr>
<td>Met-AVL</td>
<td>1:2</td>
<td>-</td>
<td>-</td>
<td>n/p</td>
</tr>
<tr>
<td>Met-MIB</td>
<td>23</td>
<td>n/p</td>
<td>-</td>
<td>n/p</td>
</tr>
<tr>
<td>NFI</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>~10-20</td>
</tr>
<tr>
<td>NYPD-FIC</td>
<td>5</td>
<td>-&gt;</td>
<td>750 (1 year)</td>
<td>-</td>
</tr>
<tr>
<td>RCMP-FIS</td>
<td>1*</td>
<td>n/p</td>
<td>-</td>
<td>n/p</td>
</tr>
</tbody>
</table>

n/p = not provided *FAVIAU figures are for all comparisons (not just face)

Agency Facial Image Comparison Workload Average Hours

The following table provides an approximation of the time that agencies have estimated it takes to complete the facial image comparison aspects of a case.

Table 15: Agency Facial Image Comparison Workload in Average Hours Per Case

<table>
<thead>
<tr>
<th>AGENCY</th>
<th>Total Staff</th>
<th>Facial Reviewer/Examiner</th>
<th>Forensic Facial Examiner</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBI-CJIS</td>
<td>14(20)</td>
<td>&lt;1</td>
<td>-</td>
</tr>
<tr>
<td>FBI</td>
<td>5(7)</td>
<td>-</td>
<td>15-20</td>
</tr>
<tr>
<td>INP</td>
<td>5:6</td>
<td>1.5</td>
<td>10-15</td>
</tr>
<tr>
<td>Met-AVL</td>
<td>1:2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Met-MIB</td>
<td>23</td>
<td>~1</td>
<td>-</td>
</tr>
<tr>
<td>NFI</td>
<td>5</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>NYPD-FIC</td>
<td>5</td>
<td>&lt;1</td>
<td>-</td>
</tr>
<tr>
<td>RCMP-FIS</td>
<td>1+1*</td>
<td>-</td>
<td>6-16</td>
</tr>
</tbody>
</table>

Average Hours: ~30 mins and if an issue then ~1.25 hours or longer. 9.25-16.75 (average 13) hours

Agency specific details are provided below.

FBI-CJIS (24 hours/5 days a week)

FBI-CJIS state that facial image comparisons take at least 30 minutes for two staff to complete, which includes both staff spending 15 minutes completing a report and facial markup sheet independently. If a conflict in opinion occurs then a further 15 minutes (at least) would be required with supervisor to discuss and to finalise an outcome, taking the whole process to over an hour.

Of the 15010 cases completed between August 2011 inception and 30 September 2012, 366 matches have been made. In many cases, the identity of the individual is known and confirmed using a facial recognition system. In other cases, a true identity has been determined. Often additional information is provided, which has furthered the investigation. Fugitives at the federal and state levels have also been uncovered through the use of a facial recognition system.
FBI-FAVIAU

Figures provided are for all comparisons not just face so the exact number of face comparisons per year is unknown. Less than 10% of comparison matters go to court.

INP (9.5 hours/5 days a week)

At the INP, the work required for each case varies greatly. The initial examine can take between 1 to 20 hours, and the review between 30 minutes to 3 hours. Some cases have multiple offenders and multiple CCTV records to review, and so the whole process can take days to complete.

Most cases plea bargain rather than go to court. All matters in 2012 were resolved without court attendance required. An average of 1.5 matters go to court per year (Please note in Israel the court system an inquisitorial one run by a judge as is done in Europe, where there is no jury).

When staff are called to attend court, staff providing evidence undertake specific case related mock court simulation as part of the preparation to present. Most of the team and others attend for development purposes, and as part of their training requirements.

Met-AVL

Met-AVL employs pre-filtering to eliminate unnecessary comparisons and to also monitor matters that have been resolved. The Met-AVL reject about 50% of requests due to them being deemed unnecessary, given the other evidence available to officers.

In 2012, 6 out of 36 matters were outsourced at a cost of between 1200 to 4000 pounds (~$1800 - $6100 Australian dollars).

Most of Met-AVL’s work involves tasking requests and quality control of the private sector reports.

The Met-AVL are presently reviewing the outsourcing of facial comparisons which may lead to an expansion of their unit as they undertake to do some or all of this work in-house.

Met-MIB (24 hours/7 days)

The MIB arrest 700-950 people a day. Most of the people have their booking/charge photos loaded into the MIB facial recognition system. Due to the volume of images the MIB is not able to run each as a biometric search, but in theory, if capacity existed, this would be best practice.

Each staff member completes about 20 a shift, taking half an hour each, but two staff look at each separately. If a conflict in opinion occurs then at least another 15 minutes is spent with a supervisor to discuss and to finalise an outcome, taking the process over an hour.
NFI

All matters for NFI are at the request of the court only, not police. This limits the number that must be done compared to the other agencies reviewed.

Three staff compare each matter independently. Where a suspect has cooperated in a recreation, those staff are not involved in the facial image comparison work to avoid any bias issues. If they disagree after discussion of their conflicting opinions, details of the disagreement is provided to the court.

Preliminary reports have a turn-around time of a week. Comparison report takes 16 hours (two days) for all staff involved. Turn around may take up to one month depending on the availability of suspect for comparison images.

NYPD-FIC

The NYPD-FIC under an hour workload includes whole criminal case histories across multiple databases with only brief facial image comparison notes. More complex cases can take several hours, and may include multiple biometric searches, video analysis and Adobe Photoshop enhancements.

From 750 cases, NYPD have made 201 matches, identifying 140 confirmed suspects, leading to 64 arrests since inception in October 2011.

NYPD request that all of those who have submitted a request come back to them within 30 days to provide feedback on the usefulness of the information provided.

RCMP-FIS

A key issue at the moment is the limited network of RCMP forensic facial examiners when having the conclusions verified. Only the East Coast Forensic Facial Imaging Specialist and the Analyst at the National Center for Missing Persons and Unidentified Human Remains are involved in facial comparison in the RCMP.

From time to time, the Forensic Facial Imaging Specialist will consult with two other non-RCMP Forensic Facial Imaging Specialists to have his conclusions verified. They are from the Ontario Provincial Police (OPP) and the Royal Newfoundland Constabulary (RNC), and were trained by the RCMP.
Summary of Findings for Facial Image Comparison Workload

Once again, although there was considerable variability in the workloads of the various agencies there are a number of key findings, listed below.

Finding 13 – Best Practice for Facial Reviewers is Working in Threes

Best practice for facial reviewers would appear to be to have two staff independently conduct the facial comparison and a supervisor review the outcome. Any conflicts in opinion are then assessed as a group. The implications, resource wise, are that at least three staff are needed for any one facial image comparison request.

Finding 14 – Vetting Requests May Improve Facial Image Comparison Resource Efficiency

The Met-AVL has an ex-police officer whose role it is to vet all new referrals for facial comparisons before they are undertaken. The assessment is based upon the need/usefulness for the investigation and other factors that could make the comparison unnecessary, such as other overwhelming forensic evidence and changes to the case. This eliminates ~50% of the referrals, saving significant costs and time. This would seem a valid step for any forensic facial image comparison area where even a highly positive report could end up having little bearing on the case for other reasons.

Finding 15 – Tracking the Usefulness and Confirmation of Results is Difficult

Almost all agencies said they have difficulty measuring the accuracy and usefulness of the work they do for police and the courts because there are no good feedback mechanisms available to track the outcomes of matters. This makes it difficult for agencies to provide data on the value of the resources and systems being used. In addition, the truth of a match or not may not be known for months or years, and systems being used do not support notification when it occurs.

The NYPD have a “within 30 days” request for feedback to determine if their response was confirmed through other means. This would seem a useful mechanism to adopt to get some feedback on the outcome of the analysis.

Finding 16 – Forensic Facial Image Comparison is Time Consuming and Resource Intensive

Most agencies conducting facial image comparisons “for court” are required to commit significant resources per case. Depending on the approach taken the first comparison and report may take the equivalent of two person days. In most cases two to three staff are involved, sometimes more.

When a matter goes to court the resourcing for preparation and attendance can involve many of the team for several hours or even days once everyone’s time has been added up.

Given every new case is likely to also be used at the time, or later, as a mentoring/training exercise, there will likely be additional time by those involved to train.

Preparing further reports and having them approved, briefing management and prosecutors, preparing large still images (possibly enhancements and crops) and easy to use video “for court”, potentially undergoing a mock court on the materials, and the time at court itself, likely amounts to days, if not weeks, for the staff involved.
SECTION FIVE – FACIAL IMAGE COMPARISON WORKSPACE AND EQUIPMENT

Every agency was asked about their laboratory and office setups, including the equipment and tools they used to carry out their workflows for facial image comparison. Agencies were also asked about their desires for conditions and equipment, and any identified or planned improvements.

Hardware – Environment and Equipment

Working environments varied greatly between agencies. Some agencies have a mixture of dedicated offices for one or two staff along with separate laboratories where specialised equipment was used for detection and comparison. Others had smaller offices that doubled up as their workspaces for comparisons with some specialised equipment in separate rooms. Others (the facial reviewers for the most part) worked in an open office environment potentially “hot desking” dedicated terminals.

Most agencies were still looking into the ideal environment setup, typically using what was available and limited in terms of finances to get or even assess what would be ideal. Newer teams tended to have better, more modern equipment, such as larger monitors.

Those with laboratories and offices, in some cases, had access to ergonomic chairs, stools and desks, allowing them to work more comfortably and to minimise Occupational Health and Safety issues. One agency mentioned that over the years staff has had back problems which had led to a workplace that allows them to vary their posture, including working whilst standing.

Lighting

Some agencies had window blackout or filtering screens (or no windows), limiting the amount of outside sunlight and other light that might reflect off monitors and physical images.

These same agencies also had varying levels of control over the types, placement and levels of artificial illumination to avoid screen reflections and eye-strain (FBI-FAVIAU, INP, Met-AVL, NFI, NYPD-FIC). These agencies, for the most part, are forensically focused areas that favour low and controlled lighting for long periods of time analysing material on screens. Some, such as FBI-CJIS, are testing different lighting types (angle, wavelength, strength). Others did not have any real control apart from minor monitor angle changes to avoid the ambient office lights.

No one identified specific standards being employed for controls over lighting, but most favoured the idea.

Monitors

Agencies screen monitors varied greatly. Some agencies only had access to a laptop or regular (19”/48cm) monitor displaying 1280 x 1024 pixels (1.3 megapixels). Others have dual 24” (61cm) monitors with digital connections for full resolution of 1920 x 1200 pixels with LED backlighting for better colour and contrast (2.3 megapixels). A few agencies had 30” (76cm) monitors capable of 2560 x 1600 pixels (4 megapixels).
Standalone systems are also common as part of a facial recognition system or for digital analysis. The NYPD-FIC, for example, have 27" Apple iMac standalone systems for video and still work, in addition to 24" monitors for their networked system. Other agencies also have larger high definition (1920 x 1080 / 2 megapixels) LCD televisions for presenting and analysing material.

None of those visited had yet been using newer, higher pixel density screens that manufacturer’s like Apple (“retina displays”) are marketing to the photography and film industry with their very small pixels allowing for four times the resolution of older laptop screens. For example a 15" screen with 2880 x 1800 pixels resolution for ~5.2 megapixels; providing better resolution than a 30" monitor on a much smaller form factor.

Those agencies with smaller monitors were interested in larger and more current technology ones to allow room for software tool pallets, multiple images to be compared at once quickly, and for their more accurate colour range (gamut) and contrast display, and to be able to view images from more modern digital cameras at closer to their native size. The cost issue appears to be the only reason that all agencies do not have multiple large scale high quality screens.

None of the agencies were advocating particular screen standards, or for any calibration tools like those used in photography studios, but some staff had a clear understanding of the benefits and did have higher end monitors and adjusted settings manually to assist their work. For facial image comparison work this appears to be a research gap to assess the more optimal sizes, resolutions, brightness, contrast etc. There was a general sense that multiple large good quality screens would assist in efficiencies in staff’s workflow.

**Scanners**

All forensic agencies had access to high quality scanners to scan in physical evidence for analysis. Scanning images in at between 600 to 1200 pixels per inch is not uncommon for smaller face images to try to capture as much of the biometric sample as possible, and then to preserve it in a lossless TIF format.

**Printers**

Printers were used for reports, typically colour laser for those reports that may contain images. Several agencies also printed photos, sometimes for comparison, but also just so the file could be viewed without direct reference to the digital copies. These were printed out on a variety of dedicated photo printers, up to the scale of those used at small photo laboratories found in shopping centres and camera stores. These were housed in separate laboratory space due to noise and chemicals, and accessible across the network.

**Disc Burners**

To efficiently provide digital copies of images and reports for clients and court, one agency has a dedicated network multiple disk printer.

**Cameras**

Some of the forensic focused areas have Digital Single Lens Reflex (SLR/DSLR) equivalent camera equipment and accessories for photographing suspects, scene recreations, evidence and for research. This is the sort of equipment that forensic photographers would be expected to have. These areas have a high degree of applied knowledge and experience in photography. Areas like the FBI-FAVIAU, for instance, have been doing leading research
into distinguishing twins, using high-end camera equipment capable of large sharp multi-megapixel images.

Some agencies had some involvement in managing the charging/booking station imagery collection. Most agencies are for reasons of cost, bandwidth, and storage, using older "point-and-shoot" cameras that still have a valid SDK (Software Development Kit) that allows remote control of the cameras from computers. In almost all cases these images are used at low resolution or down sampled to low-resolution images to accommodate existing procedures and systems that use under 1 megapixel images (usually something around 480 x 640 pixels). These images are likely to be a few generations old, as well having been cropped and then further compressed to a preferred image size, meaning that artefacts from the multiple compression processes reduce the quality of the already reduced resolution image. This reduction in quality is not desirable by anyone spoken with, but rather a limitation of ICT costs, existing vendor available software that is largely built around older image capture and exchange standards, and for use in facial recognition systems.

Manufacturers of cameras, it appears, no longer produce SDKs for current models except for digital SLRs, so this is going to force by way of natural attrition a move to either low quality "webcams" or to entry level DSLRs. Whilst this should allow for higher quality and resolution images, without off the shelf support it is likely most of the potential advantages of such cameras at charging/booking stations, will be lost. FISWG provide a capture guidelines standard which amongst many things advocates for native camera best resolution to be used, at least four megapixels for best practice, see Capture and Equipment Assessment for Face Recognition Systems\(^\text{10}\).

Almost all agencies only capture JPEG format and not the propriety RAW format that these cameras offer. Ideally the best evidence “for court”, and for image enhancement is RAW but the workflow overhead of managing and converting large files, has meant that this is not being utilised.

**Exhibits**

Most agencies accepted Compact Discs (CDs) and Digital Versatile Disks (DVDs) for exhibit management of images and video. Some agencies allow using USB (Universal Serial Bus) solid-state drives (USB sticks / Thumb drives) so that working copies and everything else produced can be kept in an easily transferable state for outside agencies, such as the courts. Other agencies only use internal system transfers (via email or directory) or non-volatile memory, such as discs produced “for court”.

Hardcopies of paperwork attached to the evidence were common in forensic areas to accept, track and record actions on property/evidence, as well as to have photos of the key contents. All paperwork aligned with internal forensic tracking systems.

**Secure Storage**

Most agencies have close proximity access to secure storage for files and physical images. Forensic agencies can keep material locally for cases to assist analysis.

\(^{10}\) [http://www.fiswg.org/FISWG_CaptureAndEquipmentAssessmentForFRSystems_v1_0_2011_05_05.pdf](http://www.fiswg.org/FISWG_CaptureAndEquipmentAssessmentForFRSystems_v1_0_2011_05_05.pdf) page 6, Section 2 (Last accessed 2 January 2013)
Software – Systems Used

All agencies had some form of Custody or Case Management System (CMS) and/or forensic property tracking systems to control the movement of and access to images. Agencies also used email, network environments and other methods to deliver images for comparison, but forensic areas then incorporated those accepted for comparison into their core systems.

Almost all agencies also kept a separate spreadsheet to track their work status and to generate internal statistics. Data typically recorded includes the following.

- Date received.
- Name and contact details of the requestor.
- Agency and jurisdiction/country.
- Format of material.
- Reasons & type for request including offences.
- Name, date of birth and criminal number of suspect(s).
- Internal primary system tracking numbers including those for property items.
- Image origin information for each image/video including type and format.
- Whether the request is “for information/intelligence” or “for court”.
- Results, such as:
  - comparison conclusion;
  - date completed;
  - working days to process;
  - date report sent out;
  - principal internal contact officer;
  - security classification; and
  - any other key notes on the case.

Photo Analysis and Viewing Software

Software used to analyse and enhance images and video, and to assist facial image comparison is very broad.

As noted in Section Three – Agency Facial Image Comparison Training Programs, almost all agencies, and all forensic areas, used Adobe Photoshop (latest and extended version in most cases) in their workflow to analyse and compare facial images. It is the default forensic software suite with remarks that it has been accepted at court, is a market leader in image analysis and enhancement, and that there are plenty of training opportunities online and opportunities for new staff to learn more advanced features.

Some agencies also use Adobe Photoshop plugins from third party vendors to assist with image enhancement. These may be helpful but could be an issue in court if the defense do not have access to them and cannot repeat the steps themselves, or if there is a challenge as to exactly what has been done to the images.

Other image software used includes IrfanView, Apple’s Aperture, Corel Paintshop Pro, and even Microsoft Paint. This is not an exhaustive list and there was no attempt to try and compare software used. The key thing the software products being used have in common is their small cost and, in some cases, simpler interface which could be more attractive to areas with a large number of staff not requiring to go to court.
Video Analysis Software

Agencies used a wide variety of different video analysis software, including having stand-alone systems to allow the wide number of propriety security viewing software systems to be loaded and used. Apple’s Final Cut Pro was one used by different agencies as it is a mainstream video editing package and Avid was also mentioned.

Typically from these video streams still frames are taken for examination in other systems. Sometimes segments of video are transcoded or “scrapped” to allow transfer from a different format to ones to then be managed by their primary video software suite.

Some forensic areas have highly specialised software to detail fragments and repair image corruption. These are highly sophisticated tools requiring training and experience to use, and to be able to present to a court.

Specialist Facial Comparison Software

Many agencies have access to facial recognition systems, and these systems have tools for comparing faces in them. This has the advantage of having tools readily available as soon as potential matches are found. Because facial recognition systems know where the eye placements are they can usually automatically reorientate and resize the images to match each other, making comparison easier. Many facial recognition systems also include a variety of tools, similar to those found in Adobe Photoshop and other software packages, to enable the operator to compare the images (often with lower training requirements than a full image software package).

There are, however, some downsides of using facial recognition systems. Facial recognition systems tend to convert all images, at least to display to the operator, into jpeg format which will introduce a loss of quality and potentially artefacts. Secondly, even the images loaded into the system may not be the full quality of those originally loaded since facial recognition systems do not normally forensically preserve images even if that is what they produce the templates from. In addition, many facial recognition systems have a limit on the pixel dimensions and/or the kilobytes of the images they will accept, either rejecting or down sampling them as part of the loading process.
Summary of Findings for Facial Image Comparison Workspace and Equipment

Given the above discussion a number key findings were identified, as listed below.

Finding 17 – Standards and Best Practice Equipment for Facial Image Comparison Lacking

There are no clear standards for the types of equipment that agencies should be using for facial image comparison. Some forensic areas, such as the FBI-FAVIAU, fall under the International Organization for Standardization (ISO) 17025 General requirements for the competence of testing and calibration laboratories, but this standard does not delve into what should be used, rather it seeks to ensure that what is done and used adheres to policy, tests and calibrations are regularly done, that quality control processes are in place, and that the whole process is managed properly and continually improved. So it leaves open the question of what equipment is best for facial image comparison, which is likely a series of research gaps, and in the meantime following what professional users of the main software tools being used like Adobe Photoshop, would seem to be the logical way forward.

Finding 18 – Environment Lighting Benefits from Control

All forensic facial image comparison areas, and especially those with dedicated laboratory space, had significant control over their workspace’s lighting. No standards were mentioned, but best practice was for lighting to be low and indirect to the monitor’s screen, a common sense approach to reduce reflections on screens and eyestrain from having to have monitors brightness up high.

Finding 19 – Adobe Photoshop Default Tool and Driver for Best Practice Requirements

As previously identified Adobe Photoshop Extended is the software tool of choice for forensic facial image comparison. As previous highlighted, most facial image comparison training courses involving tools require its use. Any agency developing a forensic facial image comparison area should have this software and appropriate training to align with the current best practice, and to take advantage of other agency’s facial image comparison training and advice, which will likely involve the use of Adobe Photoshop.

Best practice equipment for facial image comparison work is unclear, but the clear trend is that equipment should be what Adobe recommends for professional Photoshop use, as well as what is needed for relevant video editing software. Adobe’s own site has different levels for Photoshop performance and there are several technology and photography sites that provide more detailed preferred specifications for systems aimed at regular users, as opposed to minimal specifications just to use. This equates to modern processors, 64 bit systems, 8 Gigabytes or more RAM, fast hard disks (or even faster Solid State Drives), and dedicated modern compatible graphics cards. This is the trend seen by those with Adobe Photoshop and more recent equipment.

Finding 20 – There is a Trend towards Using Multiple Large Screens

The logical continuation of hardware required would be to use high enough resolution monitors that support facial image comparison workflow most efficiently, that are also of a professional standard to display images in their true colour range. If notes need to be taken electronically when comparing images then a large or second monitor to be able to do this without interfering or switching from the image comparison work would be more efficient. In addition, it should be noted that many comparisons are not simply a one-to-one face
comparison, often the comparison can involve multiple images of an individual, such as profile shots or and multiple portraits. Comparisons might also be best done showing the unaltered image along with the enhanced image when comparing to reference images.

The best practice remains unknown, and again is a research gap that could be specific to the workflow. It is clear that those users with two or more large monitors can have more images open at their native size to accommodate these issues along with their notes, making for a more efficient workspace.

Notably monitor calibration is mentioned in Adobe’s site and amongst professionals using it. For those planning to adhere to ISO 17025 this would seem to be a logical best practice, even if most images being examined are hardly professional studio images. Monitors with antireflection coatings as well may assist to compensate with environmental lighting conditions for those with limited control over light.

Finding 21 – Facial Recognition Systems Need to Better Support Forensic Processes

For those in facial reviewer areas using facial recognition systems, there is a significant workflow efficiency to have suitable comparison tools available immediately within the biometric system, rather than transferring to other applications. The present limitations to this for reviewers and more importantly examiners, is the likely restrictions and degradations to image quality caused by a non-forensic preservation for the original images for comparison. Issues include, conversions to JPEG and other lossy image formats from original, lossy image recompression, image file downsizing, cropping faces out of images, and potential losses of metadata / EXIF (Exchangeable Image File Format), etc. The same would apply to video.

Unless a system can provide the original forensically preserved images, and at worse a lossless crop of the face in the native image or lossless format, staff will be doing facial image comparisons likely with varying degrees of reduced quality images within the facial recognition system.
SECTION SIX – PROCEDURES FOR FACIAL IMAGE COMPARISON

Agencies all have some form of basic facial image comparison procedures, with areas using facial recognition systems usually having fairly simple procedures centered on administration of the system. Some agencies include notes concerning the facial image comparison outcomes in their procedures, whereas other agencies, notably the forensic ones, have procedures that can take days to work through, involving multiple people with very detailed technical and comparison documentation.

The reasons for some agencies using simpler procedures largely comes down to only having the need for a non-forensic outcome (facial image comparison “for information/intelligence” only) coupled with limitations of time to respond to requests in the support of operations. This section provides an overview of agency’s current (end 2012) facial image comparison procedures, although to avoid unintentionally inferring any criticism in this section the comments and findings here are mostly unattributed.

Agency procedures, for the most part, follow the accepted forensic examination methodology that is used for fingerprint and other forensic examinations, ACE-V, which stands for Analysis, Comparison, Evaluation and Verification. A detailed version of how this applies for fingerprints as an example can be found at the Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST), as well as at the National Institute of Standards and Technology (NIST), Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach (February 2012).

ACE-V, as described in the FISWG Glossary:

- **Analysis** – the assessment of an image to determine its suitability for comparison, including the ability to discriminate significant features.

- **Comparison** – the observation of two or more faces to determine the existence of discrepancies, dissimilarities or similarities.

- **Evaluation** – ascertaining the value of dissimilarities and similarities between two facial images.

- **Verification** – a review and independent analysis of the conclusion of another examiner.

How this is applied to facial images is still maturing for internationally recognised best practice and standards, although several of the agencies here have been successful at meeting the legal and standards requirements to present such evidence at court. The FBI funded and chaired Facial Identification Scientific Working Group (FISWG), is the only known group where international experts are meeting to discuss their research and experiences in an attempt to form these best practice standards. The work from the last FISWG meeting in November 2012, attended as part of this Fellowship, includes taking the NIST fingerprint workflows and adapting them for face.

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15. ibid
Analysis – Image Assessment, Analysis and Enhancement

Agencies assess images based upon their experience and training, for the quality and usefulness of images for the comparison process.

No Scale for Facial Image Quality

There are no standards that quantify a facial image’s value for this analysis, as there are for biometric facial recognition systems, which consider the number of pixels between the centre of the eyes (also known as the intereye distance), and the compression ratio on the image.

One of the issues that has limited attempts to provide a standard scale for facial image qualities is the many variables that exist, in terms of capture device types, image formats, compression levels, original and final resolution, as well as the focal length to and illumination of the subject, the background, and the subject’s hair, presence of glasses, age, sex, ethnicity, pose and expression etc. All of these variables have the potential to impact on the usefulness of an image for comparison.

There are international standards for controlled image capture and processing largely using the ICAO (International Civil Aviation Organization) requirements, and ISO 19794-5 International Standard of Biometric Interchange Formats – Part 5 – Face Image Data. But they do not provide a scale, rather a standard to be complied with and focused on conforming with underlying systems such as e-passport (images of faces on passports with a memory chip) and for use in facial recognition systems. There are also NIST standards for facial image capture that predominantly vary the resolution of the capture, providing a scale around resolution and also for different capture conditions and devices, but as they do not cover the full range of variables that may impact on quality they are effective for controlled capture only.

In respect of video, the standards are even less useful since most crime scene footage is not compliant due to format and imaging conditions, and little controlled capture of video is available for even reference material for comparison.

Quality Analysis and Enhancements

Analysis of image quality is left to examiners to assess subjectively and to note the issues of quality as they see them in the image and its metadata. Most forensic agencies use the latest version Adobe Photoshop Creative Suite Extended to undertake this analysis. Such analysis typically involves examining the facial images carefully to assess the usefulness by way of the level of facial detail that can be seen, as well as any issues that degrade the quality such as lighting, image artefacts, subject pose and expression.

Some agencies may also carefully examine the metadata of some images, such as EXIF, to better understand the degradation an image has likely undergone, and to see through this and other image analysis tools if any deliberate alterations have been made. Testing image authenticity is a highly specialised area, but some agencies (FBI-FAVIAU, INP, Met-AVL and NFI) have experts and tools to do this analysis.

Some agencies make very few enhancements to working images whilst others will examine images in multiple ways to see if further useful detail can be revealed and to compensate for artefacts and various distortions etc. Those doing this for video tend to be experts with specialised tools. Some agencies have separate image and video analysis areas that enhance all police imagery for forensic purposes, and so have or do limited enhancements.
themselves. They are also subject to the benefits of having dedicated specialists, but also the usual issues of delays to get their materials examined and enhanced by a separate area. In addition, such separate areas do not have expertise in facial image comparison and so may not know from the many enhancements that are possible what would be most useful for facial image comparison work.

An aggregate of all the techniques that agencies mentioned using for still images is provided in the following Table by way of a guide as to the sorts of software functionality and skills facial image comparison work requires. Many of these are also known to be used by fingerprint examiners for similar comparison purposes.

**Table 16: Image Enhancement Methods Used by Facial Image Comparison Agencies**

<table>
<thead>
<tr>
<th>Technique</th>
<th>Description/demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black and White / Greyscale</td>
<td>When one image is already greyscale. To highlight tones.</td>
</tr>
<tr>
<td>Brightness/Contrast</td>
<td>To reveal/highlight detail in light and dark areas.</td>
</tr>
<tr>
<td>Colour channels (selectively)</td>
<td>To reveal/highlight detail (red channel especially).</td>
</tr>
<tr>
<td>Convert Format</td>
<td>Convert to a lossless format / change bitrate/pixel depth</td>
</tr>
<tr>
<td>Curves</td>
<td>To reveal/highlight detail in light and dark areas.</td>
</tr>
<tr>
<td>Crop (Copy)</td>
<td>To remove extraneous; To select features to compare side by side separately and form reports.</td>
</tr>
<tr>
<td>Deinterlace</td>
<td>To “fix” PAL interlaced video.</td>
</tr>
<tr>
<td>Drawing tools</td>
<td>For measurements and markups</td>
</tr>
<tr>
<td>Duplicate</td>
<td>To create working and presentation copies.</td>
</tr>
<tr>
<td>Fast Fourier Transform Filter</td>
<td>To remove noise and enhance detail.</td>
</tr>
<tr>
<td>Gamma</td>
<td>Exposure correction.</td>
</tr>
<tr>
<td>Gaussian blur</td>
<td>To reduce image noise (artefacts) / to smooth an image.</td>
</tr>
<tr>
<td>Interpolation</td>
<td>Image enhancement/resize with digital pixel estimation.</td>
</tr>
<tr>
<td>Invert</td>
<td>Invert colours to highlight features.</td>
</tr>
<tr>
<td>Layers</td>
<td>For superimposition and for non-destructive editing.</td>
</tr>
<tr>
<td>Levels</td>
<td>To correct for exposure reveal/highlight detail.</td>
</tr>
<tr>
<td>Measurement</td>
<td>To measure the pixels between features on image</td>
</tr>
<tr>
<td>Resize</td>
<td>Effectively zoom – Interpolation is another option for small images</td>
</tr>
<tr>
<td>Rotation</td>
<td>To rotate and level the image for comparison. Invert.</td>
</tr>
<tr>
<td>Sharpen</td>
<td>A high pass filter to enhance edges, texture and detail.</td>
</tr>
<tr>
<td>Stacking image frames</td>
<td>Image stacks from video composite view to eliminate artefacts.</td>
</tr>
<tr>
<td>Transform</td>
<td>Image aspect ratio change to compensate for distortion/angles.</td>
</tr>
<tr>
<td>Transparency/Opacity</td>
<td>To allow superimposition and non-destructive editing with layers.</td>
</tr>
<tr>
<td>Unsharp mask</td>
<td>A high pass filter to enhance edges, texture and detail.</td>
</tr>
</tbody>
</table>

It should also be noted that whilst some agencies do use many of these enhancements this does not mean that they are presented to court. For this reason, some agencies use few of these techniques, whilst others use them only as a form of working notes to help them in their examination, perhaps using just one or two to assist the court. There is an acknowledgement by most agencies that the courts may not accept enhanced images. If they are accepted then expert witnesses need to be able to clearly document and demonstrate the steps taken, and explain the processes involved to make clear that no new data has been introduced. Since Adobe Photoshop is readily available as a commercial tool its use makes it much easier than other more obscure image tools, and ones such as those in facial recognition systems, that the court and defense are unlikely to be able to test and validate the evidence. In all cases such changes are non-destructive, selectively removable and repeatable, and can all be logged and noted to the degree and type of change or sensitivity or size used.
Comparison – Facial Image Comparison Techniques

There are four types of techniques for facial image comparison that are widely recognized and different agencies use one or more of them in their facial image comparison procedures. FISWG have a detailed overview of the approaches\(^\text{16}\):

- **Photo-Anthropometry** – measuring dimensions and angles of anthropologic landmarks and other facial features, quantification of characteristics and proportions.

- **Holistic Comparison** – looking at the whole of the faces at once.

- **Morphological Analysis** – features of the face are one by one examined, described and compared; and conclusions are based on subjective observations.

- **Superimposition** – using a scaled overlay on faces to visually align and compare, as well as overlaying images with different transparencies to compare.

Those using facial recognition systems to search galleries for results tend to initially use holistic comparison to quickly identify facial images for closer examination.

Some undertake superimposition, where all images being compared have very similar pose and expressions, and even then some only do this for elimination purposes and are mindful of imaging issues that might distort faces such as the subject being very close to the camera.

Of note, photo-anthropometry is regarded by some agencies as a scientifically unsound technique given the problems in accurately identifying measurement locations, the large margin of error created with small images and even small positional differences for facial images pose and expressions, and so is not used.\(^\text{17}\)

For many facial reviewers and all forensic areas morphological analysis is the accepted best practice technique to compare faces. Morphological analysis is what FISWG promote in their *Guidelines for Facial Comparison Methods*\(^\text{18}\).

At present there are no international standards for exactly what should be examined and the terms to describe this examination. This was a known issue when this Fellowship was undertaken to identify best practice and to see if standards were forming. Fortunately this is an issue that FISWG are now addressing in the one-to-one facial image comparison subcommittee, which was one of the findings from this Fellowship when the meeting was last held in November 2012.

What was identified during this Fellowship in respect of comparison techniques was a number of commonalities, but also differences and the reasons for these differences which are potentially helpful when considering the purpose for examinations and their resource implications, workflows and products. Most agencies that have or are developing these are aimed at bringing consistency and accuracy to their processes, maintaining forensic integrity.


of materials, standardising terminology, and reducing the risk of examiner bias and other human errors.

So whilst the work of FISWG will hopefully produce a best practice standard over the next few years with the direct involvement of at least all the countries visited as part of this Fellowship, there are specific issues that Australian agencies should be aware of now and will likely not be fully covered by FISWG for the Australian forensic and intelligence contexts or for the larger workflow. What follows, therefore, is a highlight of the current comparison procedures and products of the agencies visited during the Fellowship.

**Comparison – Morphological Checklists**

The consensus from agencies is that, in lieu of any standards, the best practice for morphological analysis is to use a checklist that makes sure that the examiner checks all the features and notes points of similarity and dissimilarity. For this purpose, some agencies use a collection of facial anatomy materials and pictures as reference, trusting the depth of training and supervised learning to make sure that everything is examined thoroughly – a mental checklist if you will. Others use a very specific checklist that requires comprehensive notes to be made, and fairly rigid steps for one-to-one comparison. These can prove to be more complicated and very time consuming if there are a handful of reference and questioned images that must all be examined separately and then with one to another.

As to the facial terms or references used, some agencies use anatomical terms from a handful of texts that are well known (but which also have differences between them). Others use more plain language terminology that is left up to the examiner to describe – usually for areas undertaking facial reviews not facial examinations, or when the materials are provided to police investigators to understand what has been found as part of the explanation for an opinion.

Some agencies require that notes must be made on every aspect that is compared, whilst others only on the most relevant ones. In several cases, not all of the notes made in this process are put into the report, only those viewed as most useful. These notes can then be relied upon later if need be. In some cases they are not kept and the report is all that exists.

Some agencies also use generic picture of the face, FBI-CJIS refer to this generic picture as the “ghost face”, to allow them to visually mark up the face’s uniquely distinguishing features that are used to form their opinion. Others just use their anatomy references and do not include this in their reports except as citations when needed. At the last FISWG one-to-one subcommittee meeting in November 2012 there was discussion about the creation by FISWG of generic pictures with FISWG agreed upon facial terminology that could then be publically available to everyone to help bring about consistency and standards. The next FISWG meeting in May 2013 will hopefully confirm that this is proceeding and possibly provide samples for FISWG members to review. This would help eliminate issues of inconsistency and copyright from anatomy texts that are currently relied upon.

**Comparison – Facial Image Comparison Reports**

Different agencies have different types of reports primarily for different purposes or because of resource limitations. Many agencies have a preliminary or non-forensic report that allows them to complete a quicker report (with or without an opinion), and a secondary forensic report with an opinion that is much more complex and time consuming to prepare. Some agencies only provide one or the other. Others have additional reports which, in one case, are as simple as the relevant images presented next to each other at the approximate same size and orientation to allow those receiving it to make up their own minds. The lack of
markup and opinion is to avoid any objections from the defense prior to or at court.

Complex reports tend to cover all aspects of the ACE-V process, noting almost everything about the case and its management. Here are examples of the sorts of things that can be covered by the requesting document and in the report (that all form part of the case file):

- The requestor details.
- The nature of the request and reasons (authority) for request.
- Administration (dates, places, etc.) and case tracking information.
- Description and tracking information about the property including file types and reference numbers.
- Details scanning and photography technical information including crime scene recreation data.
- Detailed image analysis findings (which can be very extensive for video covering codecs and use of specialised tools).
- Record of details any steps taken for enhancement or testing including authenticity.
- Any copies of original images and enhancements (possibly with markups) and usually with hardcopies for file.
- General description of materials and subjects in them.
- Subject name and biographical details.
- Criminal background and reference information.
- Any bias or background knowledge about the case.
- Any use and results from a facial recognition system of relevance.
- Detailed morphological checklist to note similarities and differences with remarks and comments on their importance such as how important they are for individualising and uniqueness.
- Any legal or other caveats about the product’s use.
- Any hypothesis and opinion scale used.
- Details for and the examiners opinion/conclusion and any conflicts.
- Reviewer / Supervisor / Management approval for report.
- Any protective security markings and protection from Freedom of Information (FOI) requests.
- Remarks to the effect that the report is standalone “for court” and examiners wont attend unless specifically identified as required beforehand.

Many of these reports with written checklists or reports generated from them also include comment options so that the importance of similarities and differences can be recorded, including an explanation of why an apparent difference may be due to some other factor such as aging, lighting and/or imaging issues etc.

In addition to checklists, some agencies will prepare a report with arrows or numbers (markups) to highlight the similarities and differences on copies of the images (original and enhanced). Some prefer to only provide the original images with no markups to avoid any reasons for the court to object. In most of these cases physical copies are provided as part of the report.

Those doing image markups generally require considerable extra time to prepare them and usually only complete them for matters going to court. Alternatively they complete them in two stages: a simpler non-forensic report highlighting the similarities for investigators and pre-court work; and then a more complex and detailed report with extracted image highlights and markups (with or without notes) for the court.
Most reports contain a cover sheet highlighting all the relevant information about the case, dates, contacts details, case officers, the reason for the request, possible offences involved or legal authority for request, the nature of the request itself, evidence tracking information, they may also have places for supervisors to approve the work to be done and to accept it as completed.

The reason for the variations in reporting practices between agencies comes down to a combination of purpose, local laws and legal opinion, court preferences, research limitations, and available expertise and resourcing.

One unusual case is the Met-AVL, who outsources most of their facial image comparison work. Their procedures include a quality assurance report with a set of criteria to make sure that reports are suitable “for court”. It does not delve into facial image comparison procedures but would be very useful for any agencies seeking to also outsource facial image comparison work.

**Evaluation – Opinion Scales as to Similarity**

Once the comparisons are done an opinion needs to be provided as to whether they are the same person or not. Again, there are no internationally recognised standards for this.

These subjective opinions are typically a scale of confidence based largely upon the quality of the images. Some are the same as used in other forensic disciplines. Different agencies are using different scales, some citing the lack of suitable large-scale population studies to be able to provide a statistical outcome. The scales are made up of language to describe the similarity in terms of the examiner’s training, experience and possibly with reference to relevant research specific to the features identified, the capture conditions, and/or final image form(s).

Agencies that have a “for information/intelligence” focus tend to employ a simpler scale and never positively identify the facial images as matching.

Agency scales are still under development and review, and there are some language translation issues that may also impact on the meaning presented here. The RCMP recently revised theirs to remove probability terminology, and the conclusion is now expressed in terms of levels of support. And other scales also exist outside of the countries that form part of this Fellowship paper, having in one case 9 levels and slightly different terms for higher quality images, and only 3 confidence levels for poor quality images.

Reviewing these different scales, provided in the Table below, it can be seen that some refer to the level of support whilst others talk about likelihood, in effect probability.
Table 17: Agency Facial Image Comparison Opinion Scales

<table>
<thead>
<tr>
<th>Agency</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBI-CJIS</td>
<td>Unable to process, no candidate, inconclusive, likely candidate</td>
</tr>
<tr>
<td>FBI-FAVIAU</td>
<td>No comparison possible, elimination, no conclusion (with caveats and explanations), individualization</td>
</tr>
<tr>
<td>Met-MIB</td>
<td>Possible identification</td>
</tr>
<tr>
<td>Met-AVL</td>
<td>Limited support, possible identification</td>
</tr>
<tr>
<td>NFI</td>
<td>Within Bayesian framework, about equally as likely, slightly more likely, more likely, much more likely, very much more likely when hypothesis 1 is correct than when hypothesis 2 is correct</td>
</tr>
<tr>
<td>NYPD-FIC</td>
<td>No match, image rejection (not suitable), possible match</td>
</tr>
<tr>
<td>RCMP</td>
<td>No grounds to support, limited support, moderate support, strong support, powerful support</td>
</tr>
<tr>
<td>INP</td>
<td>Cannot be compared, negative identification, probable negative identification, cannot be decided, cannot be eliminated, possible, probable, highly probable, very highly probable, positive identification</td>
</tr>
<tr>
<td>NFI</td>
<td>No candidate, inconclusive, likely candidate</td>
</tr>
<tr>
<td>RCMP</td>
<td>Limited support, moderate support, strong support, powerful support</td>
</tr>
<tr>
<td>INP</td>
<td>Cannot be compared, negative identification, probable negative identification, cannot be decided, cannot be eliminated, possible, probable, highly probable, very highly probable, positive identification</td>
</tr>
</tbody>
</table>

Of the forensic agencies some have a negative and positive scale whilst others only have a positive scale. Lack of a negative scale could be an issue which may restrict facial examiners from presenting evidence to refute any defense claims that someone else is the person of interest and not the defendant.

Some agencies specifically caveat that the opinion is with the exception of twins and family members in any outcome.

Some agencies note the number of similarities and dissimilarities, but no one specifically requires a number of them for a specific level of confidence. This presents a risk that different people using the same opinion scale will, on the same evidence, form different levels of opinion. The response to this is that the relative strengths of these levels can be made consistent as staff go through training and close supervision and mentoring over

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19 [http://www.bahid.org/index/flag](http://www.bahid.org/index/flag) [Last accessed 4 January 2013]
months and years. Having seen many (possibly hundreds of) cases and their outcomes, and having also been involved in potentially hundreds of supervised and test cases, the student can calibrate their opinion to that of the group (and agency).

Even after discussions it was not clear why some agencies had three levels, whilst others had four or five levels for positive indications of a match. Ideally it should be possible to matrix these different scales against one another but given language of the scale is meant to be self-explanatory there is a very subjective interpretation risk here so it has not been attempted.

Agencies having a forensic purpose (facial image comparisons “for court”) sometimes allow a confirmation of identity (it is the same person) on images alone to be made, although others use language that is close to this.

One issue this raises is that a lack of any internationally accepted facial image comparison opinion scale will likely present issues for police where governments exchange criminal data that include faces for comparison and especially comparison outcomes. If internal policies about outcomes of the strength of a match opinion are based upon different scales, it may be less useful to seek secondary opinions from foreign experts since they cannot be aligned easily with local ones. It will also be an issue to both rely upon and understand the comparison reports with opinions that might be provided seeking things such as investigative assets to be tasked, or even an arrest and extradition, without redoing them locally and even then it may not be possible. For example if one country requires a positive identification (this is the same person) and another country’s forensic area does not support that level of opinion, then it may not be possible to take any action as requested by the foreign country even though the accepted policy between these countries (such as a Memorandum of Understanding) supports it for other modalities such as fingerprints.

In several cases those without a positive identification opinion level mentioned that they expected the judge or jury to reach that conclusion (or not) themselves.

As previously noted, those agencies operating facial recognition systems “for information/intelligence” outcomes all expressed views that the future of such system use could see staff having to give evidence in court if their opinion formed part of the investigation’s outcome. There is a sense that long term all staff will need to be able to be appropriately trained “for court”, and that procedures may need to be altered to support the appropriate documentation to support that need.

**Verification – Second Person and Group Opinions**

Agencies with “for information/intelligence” outcomes had a mixture of requirements for secondary and even group opinions. Some have adhoc approaches that allowed for other staff to be involved. Others have strict processes requiring two independent opinions (sometimes with notes/short reports) to be formed, and any conflict to be resolved by a supervisor usually involving those involved. Two people reviewing the material is considered the minimum requirement for best practice by all those involved.

Agencies with “for court” outcomes always have a second person verify the decision, in most cases a more senior or peer reviewer takes on the role of verifier.

In addition the whole team may be involved in a case with unusual issues, difficult aspects or that is high profile. This approach allows for everyone to contribute to decisions and understand the reasoning, which can be helpful when different staff have different levels of experience or come from different areas of expertise. Typically groups independently form
their opinions and then meet to discuss their findings. It is very resource intensive and so cannot be done for most matters.

Some “for court” agencies have a process of two or even more examiners preparing independent opinions, which are then adjudicated by a more senior member of staff who finalises the report outcome. This may allow for a minority report should one of the more junior examiners still disagree. Others have one examiner preparing a draft report and a second review the materials and report to decide if they agree with the opinion.

In addition, matters going to court tend to be subject to a higher level of scrutiny as part of the preparations for giving evidence.

It should be noted that in many cases those preparing matters “for court” do not go to court, because a more senior member is part of the case and is the only one approved “for court” attendance. This places additional responsibility on those attending court to ensure a thorough understanding of the materials being presented, particularly given that they may not have been involved in the initial analysis.

**Summary of Findings for Procedures for Facial Image Comparison**

As with many other areas, there was considerable variability in the procedures for facial image comparison between the agencies, particularly when comparing facial image comparison work completed “for information/intelligence” versus that done “for court”. Several findings are summarised below.

**Finding 22 – ACE-V and Morphological Analysis are the Default Forensic Facial Image Comparison Approaches**

In forensic areas the approach being taken is ACE-V, using morphological analysis alone or with secondary support by other techniques, for facial image comparison. Other techniques are used with caution or not at all by many agencies.

**Finding 23 – Secondary Examiner Opinions are Best Practice**

Many agencies require at least two qualified staff to make all comparisons to minimise human error and bias.

Best practice suggests that comparisons are done separately by examiners and then compared. Best practice also suggests that a third person, or more, be available for matters where a conflict occurs in findings and opinion.

**Finding 24 – Removing Contextual Bias is Preferred, but Problematic**

Some agencies try to remove as much information about the subject and circumstance as possible, so that examiners are just comparing images without any potential bias from suspected or known criminal activity. For many police agencies, especially those using facial recognition systems, this is not possible or practical since images are from charge/booking stations, crime scenes or from other obviously criminal contexts. In addition, there is a workload overhead involving staff and systems to facilitate this sanitation and then provide examiners with the materials.

Of note, for crime scene recreations, the NFI staff involved in setting up dummy’s or volunteers are not allowed to then be involved in the image comparison procedures to avoid potential bias. The Met-AVL sanitises the images of contextual data prior to outsourcing the
comparisons to the private sector.

Finding 25 – There are Pros and Cons for Being an Expert at Image and Video Enhancement and Analysis in addition to Facial Image Comparison

For some agencies the same staff that have significant expertise at analysing images and video at a technical level conduct the assessment step of ACE-V, which includes enhancements and analysis, integrity issues and sometimes forensic data recovery. In other agencies, this expertise lies in a separate forensic area for face, especially those doing comparisons “for information/intelligence” only outcomes. The pros and cons are presented below.

Pros of facial image comparison staff also being image/video analysis experts
• Can immediately analyse the images and video without delay (waiting for another section).
• Can better enhance images in a variety of ways to reveal the data they know to be most relevant for facial image comparison – which may be very complex to request or even unknown (until you try different tools to see what works best).
• Can go to court for the whole of the process, not just the comparison. Will be better placed to discuss issues of resolution and artefacts that are important to poorer quality images, like CCTV.

Cons of facial image comparison staff also being image/video analysis experts
• Extra training is required for image and video analysis, and if going to court this may need to be certified skills.
• Specialised software tools required and dedicated hardware to operate it on.
• Delays to facial image comparison if working on image/video analysis for non-face matters.

Of note fingerprint examiners are trained in the collection of fingerprints, as well as to use Adobe Photoshop and other tools to enhance images, so in effect they have enough training and experience to cover the entire analysis. This would seem to be the future for facial image comparison, given some do this now and the benefits of having these skills in the same staff who are undertaking the comparisons. Given the complexity of video analysis, a compromise might be that staff get image analysis training and the video forensics remains in existing separate specialists areas.

Finding 26 – There is No Scale for Facial Image Quality

Whilst experts discuss image quality for face, there are no scales, let alone recognised standards, for assessing facial image quality. Yet staff using these images routinely talk about images in terms of different scales, such as “Good, Bad and Ugly”, for both facial image comparison work and for use in facial recognition systems. These very subjective levels would benefit from a more objective and standardised scale, to assist priorities in workflows and to manage expectations as well as bring more objectivity to opinion scales. This remains a research gap for the present. Discussions have occurred over how this might be addressed at the annual FBI/UK Home Office, International Face Collaboration meeting that was held in London in early November 2012, and attended as part of this Fellowship.
Finding 27 – Image Analysis and Enhancement Practices Vary Widely

Apart from using Adobe Photoshop Extended by most areas conducting facial image comparison, there is no clear workflow or standard practice to what analysis and enhancements agencies conduct.

Some use very minimal techniques and may not present any modified images to court. Others will provide originals and enhanced images with detailed notes to allow the steps to be repeated to show there have not been any misleading alterations.

Agencies undertaking a wide variety of enhancements report there are benefits to doing so. Apart from the legal issues and possibly the time involved, other agencies are not using all the tools available to them perhaps due to a lack of skills or more likely a lack of proof of the benefits by way of case studies.

Given these enhancements may highlight data to assist facial image comparison work and given that other agency and defense experts may, intentionally or not, use tools to obscure or alter image data, there seems to be significant benefit for staff to be trained and experienced with these tools. Ideally a forensically focused Adobe Photoshop course for face, along with relevant case study examples would be able to cover this.

Finding 28 – Facial Recognition System Enhancement Tools Need to Mimic Adobe Photoshop and Provide Detail on Settings

A potential issue is that any proprietary tools used to enhance images, such as those included in some facial recognition systems, may not be accepted by courts because the user cannot assure the court of exactly what the tools are doing. Yet for areas that use a facial recognition system, having the tools in the system is far more efficient for use and training, and potentially cost saving.

In addition, training and practice is likely to be focused around Adobe Photoshop capabilities so any facial recognition system tools would benefit from mimicking these right down to the same settings, so any use in the system in effect is exactly the same as in Adobe Photoshop. Providing a log or record of the changes done that can appear for the report or even within the system report would be a valuable part of this, especially if it then allowed someone with Photoshop to repeat the same outcome with out needing to use the facial recognition system (whether that be internal forensic examination or the legal defence team and specialists for a matter).

As per Finding 21, such facial recognition systems also need to support multiple image formats for enhancements and forensic preserving them if they are to really be able to act in place of Adobe Photoshop for facial reviewers and other non-forensic examiners.

Finding 29 – Facial Image Comparison Morphological Term Standardisation is in Development

At present expert examiners use anatomical terms for the face, but they do vary due to the source. In addition the plain language equivalents that might be used “for court” to help explain comparisons can also vary. This creates potential confusion when running facial image comparison training courses and developing procedures, for researchers examining issues like aging, for comparing opinions between different experts, and for the courts. Establishing standard terminology is the intended plan of FISWG to address these issues in the one-to-one working group.
For the Australian context alignment with these developing standards, indeed involvement in contributing to them to assure they will fully support current procedures is likely the best way forward for areas developing facial image comparison capabilities.

The FBI and NFI leadership of this work is also very relevant to police work, as these agencies, in addition to contributions from INP and AFP, are making sure that the whole range of image quality and subject pose issues that law enforcement must deal with are being considered. It would be valuable if other police agencies from Australia and overseas, notably the BKA (German Federal Police), Met-AVL and RCMP were also involved given their extensive expertise in this area.

Even if agencies maintain their own preferred terminology, if this standard comes about then it would be beneficial to have a translation document that aligns local terms with these standards to minimise confusion when training or during collaborative work using these terms.

**Finding 30 – Facial Image Comparison Checklist Standardisation is in Development**

A checklist of facial features for facial image comparison is regarded as best practice for training, day-to-day reference, and to reduce the risk of bias and human error. Some agencies follow such lists very closely, documenting all findings. Others, typically with very experienced staff, have these lists but just identify the key similarities and dissimilarities (or equivalent words) when undertaking facial image comparison examinations.

At the last FISWG one-to-one subcommittee meeting in November 2012 there was a discussion about the creation, by FISWG, of generic pictures with FISWG agreed upon facial terminology that could then be publically available to everyone to help bring about consistency and standards. This would then form the basics of the facial image comparison checklist. Further work is also planned on the best procedures to adopt when using a checklist once it is complete.

One FBI-proposed advantage of this standardised checklist is that it can be used as a spreadsheet to aggregate data on all facial image comparison work over time to see what facial features are being relied upon to better understand training, procedural, research gaps, quality control and bias issues. This can also be done internationally to share and compare with other agencies for the same reasons, as this new forensic area matures.

Given this work is going to be available in the next year or so, it presents an excellent opportunity to both be involved in developing these standards as well to design or modify agency’s own procedures for them to take advantage of the agreed upon views by international experts that have been contributing to them.

**Finding 31 – Facial Image Comparison Opinion Scales Vary Greatly**

Opinion scales vary widely and are all largely subjective. It seems that training and immersive use and experience with different cases within an agency is what gives a staff member a full appreciation of the differences between decision points on the scale for those with larger scales. It is this training and experience which allows a staff member to calibrate their subjective opinion outcome to the agency.

Any Australian agency seeking to develop similar opinion scales needs to consider the high level of contextual example material needed to accompany it to ensure that staff can develop a full appreciation for the differences between decision points, due to the subjective nature.
Again, FISWG is likely to explore a standardised opinion scale in the next few years coming out of its other standards, which could be the best way forward for agencies presently without such opinion scales for facial image comparison. It is a clear research gap at present.
SECTION SEVEN – FACIAL RECOGNITION SYSTEMS

Due to the sensitive nature of and security classifications around police capabilities, this section on facial recognition systems has been largely sanitised. Specific capabilities and uses cannot, for these mostly security related reasons, be published but will be available and discussed with Australian law enforcement agencies who hold relevant clearances. Here are some of the publically known issues.

As has been mentioned in previous sections facial recognition systems are being successfully used for controlled imagery but also crime scene material, leading to successful identifications of suspects.

Agency views are that facial recognition systems for law enforcement purposes cannot be treated as “lights out” and must involve human review. The poor quality of images being used in these systems (variable pose, illumination and expression, multigenerational images, video codecs etc.) requires humans to manage the quality issues and to look through larger galleries than is expected of users of facial recognition systems that have compliant, good quality images.

Foreign Agencies Have Centralised Facial Recognition Areas

As discussed under Finding 1, police users of facial recognition systems in the agencies visited operate in centralised specialist areas only (FBI-CJIS, INP, Met-MIB and others not specifically attributed). These areas also conduct a wide range of other background and criminal indices checks in support of investigations, or are focused on specific types of operations. These areas also sometimes operate 24 hours a day for the working week, or all week. They may also have access to other biometrics to assist identification. Australian police also have centralised areas for requests from untrained staff and other agencies, but in many cases access and use of facial recognition systems is being made available to all staff that have undertaken the set training.

Facial Recognition New Use Cases

CAST, CBSA, FBI-FAVIAU and RCMP are conducting leading research in other use cases for facial recognition systems. These efforts are aimed at better improving accuracy, supporting risk management at borders, detecting offenders in new ways, and analysing large sets of facial image data quickly.

Biometrics Training

Training to use facial recognition systems tends to be specifically focused on how to use the system. How the facial recognition systems work and how staff should use such systems to find and compare faces is left to the agency, in terms of developing training and processes for it.

Some agencies have a requirement, or acknowledge that, the Institute of Electrical and Electronics Engineers (IEEE) Certified Biometrics Professional (CBP) Program\(^{20}\) is a good introduction for those working in facial recognition system development and procurement.

Forensic Image Preservation and Images and Issues with System Integrated Facial Comparison Tools

In earlier sections there are two important issues covered that anyone looking at purchasing or adapting a facial recognition system need to consider to best support facial comparisons for court. Please see Finding 21 *Facial Recognition Systems Need to Better Support Forensic Processes* and Finding 28 *Facial Recognition System Enhancement Tools Need to Mimic Adobe Photoshop and Provide Detail on Settings*

**Support For “Latent” Facial Images**

It may sound obvious but it is worth noting that the likely success of any biometric system will also depend largely on how much data it holds to be matched against. Facial recognition systems that only hold charge/booking photos either miss the opportunity to detect images from crime scenes or all those crime scene images need to be rerun regularly against the system and against each other to not miss the chance of detections. Resourcing issues typically means this is less likely to occur and there are also issues of delays for possible matches. Ideally facial recognition systems need to be like fingerprint systems that can hold not only those charged/booked but also crime scene “latent” facial images, so that any new data is matched against the whole of the systems holdings with every check. But some agencies are not keeping the poorer quality images in their systems because the system cannot filter them out and in easily for certain tasks, and these images create “noise” in the results as like attracts like.

For example CCTV interlaced video images attract one another based on the interlacing patterns, similarly so do scanned copies of forged driver licences with holograms over the faces, and so results from a probe with these issues attract many others with the same issues, leading to non-face pattern matching issues. But not keeping these “latent” facial images risks missing potential identification of offenders.

**Summary of Findings for Facial Recognition Systems**

Although the above discussion on facial recognition systems was limited, due to security issues, the following finding is offered.

**Finding 32 – Facial Recognition Systems for Latent Facial Images**

For facial recognition systems to best support police use, consideration needs to be given to supporting the issues of poor quality imagery from crime scenes and from investigations surveillance and other sources.

Ideally facial recognition systems should be able to rate face image qualities along an internationally agree upon scale (see Finding 26 - *There is No Scale for Facial Image Quality*) and support filtering on this quality and other metadata, to compensate and improve biometric search accuracy by presenting more relevant gallery results to operators for a decision.

Some systems do some of this for biographical and metadata but image quality levels tend to be user (subjectively defined) and/or proprietary system assigned values or terms lacking proper consideration of crime scene image issues. Experience shows that small changes in eye placement of system assigned ones, changes to images using image tools, and filtering on user assigned quality levels, will return different gallery results which can lead to a match that was not seen without this human intervention.
SECTION EIGHT – RESEARCH AND IMPROVEMENTS FOR FACIAL IMAGE COMPARISON AND FACIAL RECOGNITION SYSTEMS

Whilst some agencies have been undertaking facial image comparisons for decades, in some cases several decades, and presenting evidence successfully to courts, as a forensic discipline facial image comparison is still maturing. With that comes the requirement to invest in research to continually improve the science underpinning it.

Below are select issues of note in respect to efforts to improve facial image comparison work.

Improve Facial Image Capture – Booking Stations

All agencies were aware of the problems and limitations that occur from crime scene and even controlled captured faces. Whilst movies and television shows would suggest that technology is able to enhance poor quality images greatly, the fact remains that there is generally very limited enhancement that can be done. One obvious solution is to capture and retain better images and video.

In most cases this is not possible. Whilst law enforcement agencies can advise and promote better lighting, better camera placement, better quality cameras and smarter compression techniques, it is expected that in most cases there is little that can be done to force private and even government CCTV to be of better quality. Since 2010 the FBI have been promoting better standards and FBI-FAVIAU have a 20 minute program that provides do’s and don’ts advice on how to deploy CCTV called Caught on Camera that is publicly available and free for non-commercial use.

In respect to booking station/charging processes where one or more photos are captured, several of those met expressed an interest in obtaining better quality, notably improved resolution images, and more images of the face to assist with facial image comparison.

Many agencies currently acquire images around about 480 wide by 640 high in pixels (307,200 pixels – less than a third of a megapixel). These images are of the face front on, the portrait. Sometimes they get two, with and without glasses. Several agencies get one side shot of the head, the profile, but not both. Some get an image at approximately 45 degrees to the head, a three-quarter view, but only one not two.

The lack of resolution and the lack of both profiles and/or both three-quarter views are all things that agencies have found problematic when the crime scene views they have are for the facial aspect not captured by their booking processes. Ideally all five views at better quality would be captured to assist with future matching in facial recognition systems and for facial image comparison.

The challenge here is to address concerns over additional work to capture, the cost for cameras, bandwidth and storage of these larger and more numerous images. There are NIST and FISWG standards for facial capture but at present the higher level they promote still appears to be regarded as too costly to be implemented, except for research projects.

The value to having better controlled capture would likely be more accurate identifications, better facial recognition system performance, and better forensic evidence “for court”.

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Three Dimensional Capture of Facial Features – GES-3D

The next evolution of booking/charge stations might be three-dimension capture using multiple cameras, structured light, and other techniques. The real advantage of this to law enforcement is the quality and aspects of capture, which then allow images of heads to be rotated to align with crime scene images, allowing better facial image comparison practices – with a clear focus on ears as well.

It is not intended here to comment further, but for those agencies looking at upgrading their booking/charge stations, it could be of significant benefit to include the potential outcomes of these projects in assessment and strategic planning.

“The aim of this project is to develop an easy to use multi-biometric system for identification of suspect persons from photographs or video data using 3D facial images. This new tool will assist the investigators in their work by making identification possible even from partial facial image captured with low image quality.”

This project involves the Fraunhofer Institute, other researchers and several vendors, and the specifications and evaluation involves the German Federal Police (Bundeskriminalamt – BKA).

There is prior research in this area by other universities, such as the University of Twente in the Netherlands. The GES-3D project is of particular interest because its objective is to build something affordable and easily deployable for law enforcement purposes.

European Network of Forensic Science Institutes (ENFSI) Digital Imaging Working Group (DIWG)

Each year one of the members of the ENFSI-DIWG prepare and analyse the results of a facial image comparison test. The purposes are many but include seeing what facial features examiners are relying on, the time spent, and what image quality and subject pose issues limit or make comparison impossible. In 2012 Sweden hosted this event. Analysis is presented at their annual conference in September each year.

This group has and will continue to produce research on the sorts of crime scene imagery issues that police must deal with. There is potential that the findings coming from future work of DWIG will provide research findings on what facial features can be relied upon, issues of bias and error rates, and the overall performance of examiners on different qualities of images.

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23 ibid


25 [https://forensic.to/webhome/enfsidiwg/](https://forensic.to/webhome/enfsidiwg/) (Last Accessed 8 January 2013)
Summary of Research Gaps Identified in this Report

During the course of this paper a number of research gaps were identified. These include:

- Further research to understand the abilities, expertise and training issues required to adequately prepare someone for facial review, facial examination and forensic facial examination work.

- Research to investigate the impact of screen type, size and number on facial image comparison work.

- Research to investigate the optimal workspace design for facial image comparison work.

- Research to investigate the impact of different software packages, such as Adobe Photoshop enhancement tool types, on facial image comparison work.

- Research to inform the development of standards for facial image quality assessments, specifically for lower quality images and video.

- Research to inform the development of facial image comparison checklist and procedures – something that is presently being undertaken by FISWG.

- Research to examine the issue of contextual bias in facial image comparison work, and the procedures that could be introduced to manage it.

- Research to determine the best method of presenting candidate list/gallery images to facial reviewers using a facial recognition system.

- Research to inform the development of standard opinion scales (or a standard interpretation of the multiple scales currently available) for the outcome of facial comparisons.
CONCLUSIONS AND RECOMMENDATIONS

The opportunity provided by the Churchill Fellowship to travel to meet with leading police users of facial recognition systems and those conducting facial image comparisons has been invaluable. Here are the conclusions that have been drawn from the findings for best practices and current directions that agencies are taking in the use of facial recognition systems and for facial image comparison procedures.

1. Facial Image Comparison – A Developing Forensic Science Discipline

Facial image comparison in support of police work is a relatively new and rapidly developing area for most agencies, especially in terms of being an accepted forensic science discipline such as fingerprints. Some agencies have well established forensic teams dating back decades with a high level of expertise and experience in facial comparison, notably the Bundeskriminalamt (German Federal Police) [not part of this Fellowship report], the Federal Bureau of Investigation, the Israeli National Police, and the Netherlands Forensic Institute. There are also experts of note in the London Metropolitan Police Service and the Royal Canadian Mounted Police. It is these teams and experts who will be the key to maturing this forensic discipline for police everywhere.

Agency procedures, for the most part, follow the accepted forensic examination methodology that is used for fingerprint examinations, ACE-V, which stands for Analysis, Comparison, Evaluation and Verification. All forensic areas are principally using morphological analysis (features of the face are examined one-by-one, described and compared; and conclusions are based on subjective observations) to compare faces.

At present there are no international standards and limited documented agreement of best practices as to how exactly to follow ACE-V for facial image comparison work. Many agencies have very mature practices that are suitable for their purposes and acceptable to their courts, but there are no agreed upon international standards and their practices are not readily available to be shared. Other agencies are still developing their own agreed upon best practices, if not standards, to bring about consistency based upon the best scientific research available. The issues in broadbrush terms include:

- the lack of an agreed upon scale and/or guidelines to analyse the facial image quality,
- standards on the best practices to enhance images and video of faces,
- the need for agreed upon terms and diagrams to describe what is examined (the facial anatomy) and to describe this examination,
- an agreed upon opinion scale to describe findings, and
- what verification procedures should be used.

This lack of standards was a known issue when this Fellowship was undertaken to identify best practice and to see what standards were forming. Even with all these issues fortunately there are international efforts to collaborate to develop these facial image comparison standards and best practice currently being undertaken within the Federal Bureau of Investigation’s Facial Identification Scientific Working Group (FISWG). FISWG, whose membership is made up of the agencies visited in this Fellowship as well as other government agencies and academics, is the key to establishing standards and best practices for facial image comparison for international adoption.

FISWG are now addressing many of these issues in the one-to-one facial image comparison subcommittee.
At the last FISWG one-to-one subcommittee meeting in November 2012 there was discussion about the creation, by FISWG, of agreed upon anatomical terms as well as generic pictures with FISWG agreed upon facial terminology that could then be publically available to everyone to help bring about consistency and standards. There is also discussion about best practice image analysis and enhancement, and evaluation opinion scales for future work.

The recommendation is for police to actively participate in FISWG’s document development process for one-to-one comparison standards, including membership though attendance at its biannual meetings, to be able to align, contribute to and adopt these best practices and standards for facial image comparison as they are established. The FISWG meetings are typically held in April/May and November each year in Virginia, USA.

2. Facial Image Comparison Roles and Outcomes

There are, for the purpose of this report (and modified from FISWG terms), three primary types of staff roles in agencies who compare images. In simplistic terms the order they appear here is in increasing levels of expertise to compare faces, which also includes the training, resources and time to make such comparisons. Most Australian police areas would fall into the facial reviewer roles for their use of facial recognition systems. It is recommended agencies consider the benefits of developing these higher expertise roles to improve comparison accuracy, reduce the risk of human bias and error, and ultimately provide forensic outcomes to support investigations.

**Facial Reviewer:** Evaluates one-to-many galleries either manually or with the assistance of an automated facial recognition system. One-to-one comparisons are done but no or limited notes are made, typically with limited time. Performed for information or intelligence purposes to support investigations.

**Facial Examiner:** Performs a rigorous one-to-one analysis, comparison and evaluation of controlled and uncontrolled images for the purpose of effecting a conclusion. Time and tools are available to perform this task, and best practice is to also have an independent secondary opinion performed. Performed for information and intelligence purposes to support investigations. May also include using facial recognition systems (facial reviewer role) and preparing matters for Forensic Facial Examiners.

**Forensic Facial Examiner:** Performs a rigorous one-to-one analysis, comparison and evaluation of controlled and uncontrolled images for the purpose of effecting a forensic conclusion. Qualified and permitted by agency to perform examinations of faces “for court”. Time and tools are available to perform these tasks. May also include using facial recognition systems (facial reviewer role).

3. Forensic Facial Image Comparison Training

For Australian police there is a lack of forensic facial image comparison training and certification process for the sorts of crime scene imagery and other police forensic issues that staff can undertake to become forensic facial examiners. Even without agreed upon (if not binding) internationally developed standards, several countries are successfully undertaking forensic facial examinations and many more are involved in facial reviews and non-forensic examinations.
A key objective of the Fellowship was to identify any existing or developing facial image comparison training packages and courses that might benefit Australian police in establishing their own forensic facial image comparison areas. Ideally rather than starting from scratch or with a few bits and pieces, Australian staff would undertake the training and testing, and then have the expertise to adapt these for Australian legal and other conditions. Sadly, whilst there are training packages and they are available and even delivered in Australia, they are not a complete answer when one looks closely at what is required of foreign agencies.

All agencies with teams of forensic facial image comparison experts (FBI-FAVIAU, INP, NFI) visited as part of this Fellowship (including the Bundeskriminalamt (German Federal Police) who are not visited or covered in this report) have extensive in-house training which takes place over years and involves close mentoring as well as a range of courses, practical experience with real casework using the current tools available, and internal examinations. Their requirements, duration, content and testing all vary, but they are all aimed at developing staff as forensic experts.

Beyond a lengthy secondment to one of these agencies to develop someone to be a trainer (or the reverse, to second someone to an Australian agency), the best way forward for police looking at developing these skills in Australia is to model their own development packages upon those of these agencies and to take advantage of the few courses that are available and being developed.

Overseas agencies also seek each others support in verifying their findings which could be a useful mechanism to help share techniques, minimise bias, and develop best practices locally.

From Section 3 of this report such a course is likely to include the following:

**Forensic Facial Examiner**

Training typically includes:

- Advanced facial comparison training and knowledge - comparison history and current practices, issues of aging, comparing twins, deliberate alterations such as makeup and surgery, ethnic group differences etc.
- Forensic photography training - 2 weeks or more.
- Forensic image analysis and enhancement.
- Forensic video editing, analysis and enhancement.
- Expert witness/court/law training - history of image comparisons at court, case law, admissibility, and including court attendance to see forensic evidence given, including testifying training such as mock courts with real lawyers and judges in some cases.
- Knowledge and exposure to other forensic disciplines involved in human comparisons - may include handwriting and fingerprints, including issues around bias and error rates.
- Understanding of statistical/Bayesian probabilities.
- Detailed (facial) anatomy course and required reading materials.
- Knowledge (and experience) with facial recognition systems - understanding of biometrics versus forensics.
- Many agencies have on the job experience with close supervision and mentoring requirements.
Other education and experience requirements, and key duties for the supervisory/management levels include:

- Knowledge of primary facial comparison cases studies and the relevant laws for evidence and comparisons.
- Actual experience giving evidence on facial comparisons in court.
- Developing the facial comparison field and publishing peer reviewer research papers to address research gaps.
- Regular international liaison with international experts to support the development of best practices, facial comparisons standards and to increase knowledge of case studies and research being done.

The most relevant course to help establish a working knowledge of best practice forensic facial image comparison for police work is the FBI *Facial Comparison and Identification Training* course which was run in 2012 in Australia (and might be available again in Australia if demand and appropriate funding could be identified). This course has been run for members of the London Metropolitan Police and is now being used to train CJIS and other US law enforcement staff. An advanced version of this course is now under consideration by FBI-FAVIAU with support and assistance of the FBI Biometric Centre of Excellence (BCoE).

Another training possibility is the UK Government training package, which is presently being assembled. If this is available once completed it could form the detailed underpinnings for local training procedures, especially if it aligns well with FISWG’s work.

In conclusion then the recommended way forward is to align with FISWG best practice and developing standards, and to foster sharing of specific detailed successful and scientifically valid practices and knowledge for analysis and comparison tools.

### 4. More Court Attendance For Facial Image Comparison Staff in the Future

About a quarter of the facial image comparison staff from the agencies met are preparing reports “for court”. This figure is expected to rise as those agencies operating facial recognition systems “for information/intelligence” outcomes all expressed views that the future of such system use could see staff having to give evidence in court.

The recommendation is to plan for the expectation that all staff performing any sort of facial image comparisons – notably those using facial recognition systems – will have to be trained to give evidence, and that systems and processes will need to support this.

### 5. Facial Image Comparison Areas Also Have Expertise in Forensic Photography and Image/Video Analysis

All facial image comparison areas are regularly encountering video material, stills and raw/extracted footage. Most of the facial image comparison forensic areas visited had a high level of expertise in both image/video analysis and enhancement within their facial image comparison area (FBI-FAVIAU, INP, Met-AVL, NFI). To do this they have training in forensic photography and video analysis, and a range of tools to allow them to undertake this analysis and enhancement work.

The recommendation here is that facial image comparison areas have at least a basic awareness of the best practices and capabilities of what can be done by such specialist areas. Where a separate video analysis section exists, that a close working relationship be established so that they are aware of what facial image comparison examiners need from
the materials they are tasked to process. Ideally though, the international setups visited suggest that the same unit undertaking facial image comparison work should also have some expertise in forensic image/video analysis and enhancement.


The basic software tool for all image enhancement and image comparisons by most agencies is Adobe Photoshop Creative Suite Extended version. It is understood that Adobe Photoshop is used because it is a well understood, publically available and a court accepted software tool that allows trackable and repeatable steps to enhance and markup images to assist the court. The obvious recommendation here is that any agency planning to do facial image comparison work needs this software and appropriate training in its use.

There are a wide range of other environment, hardware and software tools that need to be considered for efficiency and capability of facial image comparison work. They are largely centered on using software like Adobe Photoshop and other video equivalents, and focus on lighting, monitor requirements, hardware specifications, other software tools etc. that one would expect of a professional photo/video studio. Recommendations include:

- Controlled lighting to avoid screen glare, reflections and eye strain.
- High quality monitors, large and multiple, to improve efficiency and accuracy for the workflow and comparisons. This is especially true for areas where several images may be examined at one time and checklists and reports completed. This includes monitor calibration systems.
- Stand-alone systems to use propriety software where existing systems will not properly support the processor and graphics systems requirements or workflow that may involve uploading a lot of media quickly without the involvement of ICT or problematic security processes.
- Photo printers and media copiers to prepare reports and materials “for court”.
- Other video and image analysis and enhancement tools to process evidence.
- Access to agency facial recognition systems.

7. Forensic Facial Image Comparison is Time Consuming and Resource Intensive

Most agencies conducting facial image comparisons “for court” are required to commit significant resources per case. Depending on the approach taken the first comparison and report may take the equivalent of two person days. In most cases two to three staff are involved, sometimes more.

When a matter goes to court the resourcing for preparation and attendance can involve many of the team for several hours or even days once everyone’s time is added up.

Given every new case is likely to also be used as a mentoring/training exercise at some point in the future, there will likely be additional time by those involved to train.

Preparing further reports and having them approved, briefing management and prosecutors, preparing large still images (possibly enhancements and crops) and easy to use video “for court”, potentially undergoing a mock court on the materials, and the time spent at court itself, likely amounts to days for the staff involved.

Vetting requests for comparisons “for court” is a very valuable procedure to avoid unnecessary comparisons being done due to these resourcing implications. The Met-AVL
have a dedicate officer for this purpose. Other areas have their supervisory or management staff conduct this vetting.

Any agencies seeking to develop a facial image comparison capability should keep in mind that foreign forensic face teams exist they average about six staff to manage the work they receive, especially if they also operate and support a facial recognition system for the agency.

8. Facial Recognition Systems Success and Growth

Facial recognition systems themselves have only been in use by governments for the last decade or so, and most are designed around the use of relatively high quality facial images. Even so (and covered in much more detail in the classified version of this report) law enforcement agencies have been able to use poor quality images and adapt this technology to resolve crimes and support investigations, and this is an active area of work and experimentation. These successes are driving the uptake of these systems.

Essential to their successful performance are inbuilt system search and filtering tools to cope with poorer quality images, and human operators trained to use the systems as well as to analyse and enhance crime scene images and video, and to search for and compare the faces the systems return.

9. Managing a Decentralised Facial Recognition User Base

Australian police forces are offering access to facial recognition systems to officers who undertake training and not requiring all the facial recognition system use be done by a central area. This has issues with less experienced staff potentially being less accurate. The recommendation here then is twofold are largely for facial image comparison than any specific system issues (although how to best search galleries is a research gap):

- For important persons of interest and when dealing with poorer quality facial images, a specialist facial recognition area should be involved to increase the likelihood that a match is found through image enhancement, and by those with more experience at searching galleries and comparing faces.

- For any high or confirmed matches in a facial recognition system, best practice should be for one or two trained persons from a specialist area or even better a forensic one, to be required to confirm that a match has been made to reduce the chances of misidentifications.

10. Seeking Higher Levels for Current Charge/Booking Station Image Quality

The images being captured, even under controlled conditions, by existing processes of booking/charging criminals and from other lawful sources, mostly have not advanced in quality standards for many years. A key reason for this is that most facial recognition systems are designed around the ICAO standard’s that allow images to be cheaply stored, and quickly transferred through systems and from e-passports wirelessly. In the last half a decade technology has advanced so far and become so much cheaper for high quality and multiple image capture, that it should be viable to collect images to these higher existing standards. Because humans play such a large role in deciding the outcomes of systems and forensics, better data collection and storage standards will bring about more reliability and
confidence in these processes, and likely reduce the issue of human error. In addition, the largely financial reasons for not doing this in the past are becoming less and less of a factor.

The recommendation here is for agencies to review and seek a much higher image dimension size (multiple megapixels) along with all the other standards and best practice for facial image capture, using the best quality settings of the cameras, with minimal subsequent cropping and compression for images of faces captured. Ideally they should be forensically preserved by the system to only allow working copies to be enhanced to maximise their usefulness for comparison and “for court” purposes.

Concluding Remarks

Winston Churchill’s legacy which has provided me with this Fellowship has allowed me to see what I believe is history in the making; an internationally developed set of standards and best practice that will become the basis for the forensic science of facial comparison to support law enforcement work. From the people I have met and seeing the work they are doing, I know the expertise is out there within agencies and their experts, much like I am sure it was before fingerprints and other forensic disciplines formerly formed and were recognised at an international level. I hope this report assists not only Australian developments and involvement in this field, but also helps recognise and support the continued efforts of these international experts and their agencies to make the time for the research, meetings and to work on the documents that should bring this about in the next few years.

So I hope those I have met with as part of this Fellowship and those I know to be leaders in this area can continue to be involved in the Facial Identification Scientific Working Group. And for those who are not involved, I ask that you seek to support this work so that we can all benefit from the best collective research, experiences and knowledge to establish the discipline of forensic facial comparison.
APPENDIX 1: OVERALL AGENCY STRUCTURES AND STAFFING

This appendix provides an overview of the structure and staffing of those agencies conducting facial image comparison and using facial recognition systems. It contains the raw data collected, highlighting agency functions, staff structure and responsibilities. For security reasons some of the agencies visited and/or some of their capabilities have not been reported here. Where possible their contributions have been incorporated into this public report and more fully in a classified version for law enforcement use.

Israel
   Israeli National Police (INP) – Criminal Album Unit

Netherlands
   Netherlands Forensic Institute (NFI) - Image Analysis and Biometrics

UK
   Home Office – Centre for Applied Science and Technology (CAST)
   London Metropolitan Police – Metropolitan Intelligence Bureau (MIB)
   London Metropolitan Police – Audio Video Library (AVL)
   London Metropolitan Police – Multimedia and Biometrics (M&B)

USA
   Forensic Audio, Video, and Image Analysis Unit (FAVIAU) Federal Bureau of Investigation
   Criminal Justice Information Services (CJIS) Federal Bureau of Investigation
   New York Police Department (NYPD) Facial Identification Centre (FIC)

Canada
   Royal Canadian Mounted Police (RCMP)
   Canadian Border Services Agency (CBSA)
**Israeli National Police (INP) - Criminal Album Unit**

Criminal Album headed by a Superintendent.

**Structure:**
- Israeli National Police
  - Division of Identification and Forensic Science
  - Laboratory Digital Evidence and Criminal Album
  - Criminal Album Unit
- Digital Evidence [photography and video] – headed by a Superintendent
- Voice Recognition – headed by Superintendent
- **Criminal Album Unit – headed by Chief Inspector**

**Functions:**
- Facial Comparison (for intelligence but mainly for court)
- Facial Recognition
- Charge photo capture standards
- Photoboard / Lineups for police witnesses

**History:**
- Formed 1998 (Criminal Album)
- Using facial recognition systems since 2010
- Undertaking facial image comparisons since 1990
- Taking facial image comparison evidence to court since 1990

**Staff (6*):**
- Headed by Chief Inspector – Responsible for all facial comparisons including taking evidence to court, policy and procedures development and adherence, training, image capture standards, facial recognition system use and development, and international liaison.
- Five primary face comparison staff (includes Chief Inspector and Deputy Head) – Responsible for facial comparisons, video and image processing and enhancement.
- One technician - Responsible for FR system use (gallery searches) and technical maintenance of charge (booking) stations country wide.
- Administration support.
  *Deputy Head also provides expert facial comparisons and supervision.

**Capabilities:**
- Facial image comparison - for “information” and for court.
  - 5 – Unit head and four (4) staff involved in facial image comparisons.
  - Currently in the process of finalising standard procedures.

- Facial recognition system
  - One (1) primary user, all staff have access.
  - Considering tender for new system for more capability – including higher number of images, and more functionality to support business processes that are still be defined.
Netherlands Forensics Institute (NFI) – Image Analysis and Biometrics

Falls under Digital Technology and Biometrics Area - headed by a Manager Forensic Biometrics.

Structure:

**Netherlands Forensics Institute**

![Diagram of NFI structure]

**Digital Technology and Biometry**

- Digital Technology [Computer forensics]
- Software Engineering [Build own software tools]
- Knowledge Centre Intelligent Data Analysis [Large scale data mining]

**Forensic Biometrics**

Functions:
- Traffic Accidents [Image analysis]
- Documents [Image Analysis]
- Hand Writing [Image analysis]
- Speech and Audio
- Fingerprint Detection [Image analysis]
- Fingerprint Individualisation [Image analysis]

**Image Analysis and Biometrics**

- Image recovery and repair
- Photogrammetry
Facial Comparison (for court only)

History:
Formed:
NFI: 1999 merger of Forensic Laboratory and the Laboratory for Forensic Pathology
Department of Digital Technology: 1996
Product group Image Analysis and Biometrics: 2000
Team Forensic Biometrics: 2012 merger of product groups including Facial Comparison, Speech, Handwriting, Fingerprints and Documents
Using facial recognition systems since 2003
Undertaking facial image comparisons since 2003
Taking facial image comparison evidence to court since 2003

Staff (5):
Headed by Manager Forensic Biometrics – Responsible for all facial comparisons including taking evidence to court, policy and procedures development and adherence, training, and international liaison.
Two (2) expert level face comparison staff (includes manager) – Responsible for facial comparisons, video and image analysis.
Three (3) other face comparison staff (but not for court), specialising in different image and video analysis and enhancement techniques such as codecs, photogrammetry etc.

Capabilities:
Facial image comparison - for court.
Five (5) staff involved in facial image comparisons, image and video analysis and related techniques

Facial recognition system – None for casework (only one-to-one comparison)
United Kingdom – Home Office Science – Centre for Applied Science and Technology (CAST) – Identity Assurance

Centre for Applied Science and Technology (CAST), Identity Assurance area - headed by a Deputy Director.

Structure:
Home Office
  Home Office Science
  Centre for Applied Science and Technology (CAST)
  **Identity Assurance** area

CAST has many research areas including:

The research draws on staff from the following functional homes:

Functions (of the CAST Biometrics area):
- Biometric Advice to UK HMG
- International Standards (SC 37 working group 3, 4 & 5)
- Facial Recognition system evaluations
- Human facial image comparison using Closed Circuit Television (CCTV)
- Facial Recognition Library for performance evaluation

History:
- Formed (the organisation was formed in 1960’s.
- Interest in Biometric (and Facial Recognition) systems circa 2005.
- Renamed CAST (Centre for Applied Science and Technology) in 2011

Staff: 4
- As relates to facial recognition (and wider Biometrics) but other video specialist staff and software engineers can be drawn upon being around 15 other members of staff that work in directly related areas of video analytics, and software programming.

Capabilities:
- Provide strategic advice to the UK government on Biometrics covering:
  - Interoperability
  - Privacy & Civil Liberties (including Privacy Enhancing Technology)
  - Technical / Performance Testing
  - System Engineering
- Facial recognition system testing for operational systems
- Working with universities
- ERNCIP Applied Biometrics lead Critical Infrastructure Protection (European Reference Network for Critical Infrastructure Protection)
United Kingdom - London Metropolitan Police – Audio Video Laboratory (AVL)

Audio Video Laboratory headed by Senior Digital Forensic Practitioner.

Structure:
  London Metropolitan Police
  Specialist Crime and Operations 4 (SC&O4) Forensic Services
  Digital and Electronic Forensic Services (DEFS)
  **Audio Video Laboratory**
  Computer, Phone and Cellsite Analysis

Functions:
  - Facial Comparison (quality assurance of outsourced work)
  - Imaging and video analysis.

History:
  The Metropolitan Police Video Lab formed by the joining of the separate Analog and
digital labs in 2005. The Video Lab then joined with Audio in 2011. The Video Lab
has been actively managing image comparison since 2007.

Staff (1*): *All FIC work outsourced so capacity effectively much higher.
  An ex-police officer also assists acting as an initial assessor of requests for face
  comparisons (non-technical).
  Comparison assistance also provided by one digital forensic practitioner from the
  Audio Video laboratory however this is not their core role.

Capabilities:
  - Facial image comparison - for “information” to support operations and for court.
  - In most cases court materials are prepared by private sector “experts” and quality
    assured through this section. In the United Kingdom there are several companies
    offering these services.
United Kingdom - London Metropolitan Police – Metropolitan Intelligence Bureau (MIB)

Metropolitan Intelligence Bureau and is known as RED 24/7 Intelligence Support Unit - headed by Detective Superintendent.

Structure:
- London Metropolitan Police
  Metropolitan Intelligence Bureau (MIB)

Metropolitan Intelligence Bureau Functions:
  - Facial Comparison (for information only, “Possible Identification”).
  - Facial Recognition.
  - Fast Time Intelligence Support for Critical or Serious Incidents.

History:
  - Formed 1999.
  - Using facial recognition systems since 2003.
  - Undertaking facial image comparisons since 2003.

Staff (23 – 24/7 response):
  - Headed by Detective Superintendent
  - Intelligence Officers – responsible for intelligence products that’s includes facial recognition system use and facial image comparisons (but not for court).

Capabilities:
  - Facial image comparison - for “information”.
  - Facial recognition system – 23 staff using 2 terminals.
    - Image enhancement to improve matching and to compare images.
United Kingdom - London Metropolitan Police – Multimedia and Biometrics

Multimedia and Biometrics is headed by Principal Technologist.

Structure:
- London Metropolitan Police
  - Directorate of Information
  - Strategic and Emerging Technology (S&ET)
  - Multimedia and Biometrics section

Multimedia and Biometrics Functions:
- Metropolitan Police Service (MPS) Face recognition user group - incorporates wider community for engagement.
- Facial Recognition System testing and support for operational areas.
- Charge photo capture standards development.
- Other technologies to support police work, such as Stop & Search, Digital Interview & Speech to Text.

History:
- Formed: 2006.
- Assessing and supporting facial recognition systems since 2006.

Staff (4 including Principal Technologist) [Involved in facial recognition systems]:
- Headed by Principal Technologist
- Senior Technologists – Responsible for
  - Ongoing testing and support of operational systems
  - Development of face recognition capabilities through bench (technology), scenario and operational testing
  - Deployment of additional face recognition capability

Capabilities:
- Facial recognition system – Testing systems and cameras for different police uses, and supporting other areas of the London Metropolitan Police who have operational facial recognition systems.
- Also looking at soft biometrics for identifying persons of interest as part of facial recognition solutions
United States of America – Federal Bureau of Investigation - Forensic Audio, Video, and Image Analysis Unit (FAVIAU)

Digital Evidence Laboratory, headed by Assistant Section Chief.

Structure:
FBI Director
  Deputy Director
  Executive Assistant Director of Science and Technology Branch
    Operational Technology Division
      Digital Evidence Section
        Digital Evidence Laboratory

Digital Evidence Laboratory includes:
FAVIAU (Forensic Audio, Video and Image Analysis Unit)
CART (Computer Analysis Response Team)
RCFL (Regional Computer Forensics Laboratories)

FAVIAU Functions:
1. Forensic Audio
   a. Enhancement
   b. Authenticity
   c. Signal Analysis
   d. Speaker Identification
2. Video Analysis
   a. Enhancement
   b. Authenticity
   c. Special Effects
3. Image Analysis
   a. Image Processing
   b. Photogrammetry
   c. Image Authenticity
      i. Included image source
   d. Photographic Comparison
      i. Facial Comparison (for intelligence and court), includes comparison of body parts for inclusion/exclusion (hands, torsos, etc.)
      ii. Facial Recognition system development for automation of human tasks and for new use cases in collaboration with Biometric Centre of Excellence.
      iii. Photographic comparisons of all objects not otherwise covered by existing disciplines (e.g., clothing, automobiles, firearms).

Charge photo capture standards developed through FISWG
Chair Facial Identification Scientific Working Group (FISWG) until 2015

History:
1. FAVIAU Formed in 2000 through merger of multiple audio, video and image analysis components across FBI. Photographic analysis dates back to 1930's.
2. FBI undertaking Facial Image Comparisons since 1950’s if not earlier. This evidence used in court since at least the early 1960’s (some sources indicate in 1950’s as well.)
3. FBI using facial recognition systems only since 2011.
Staff (7 facial examinations):

- ~35 Government and Contractor Staff
  - Unit Chief – Responsible for adherence to all laws and regulations; strategic planning; human resource allocation; and overall management at the Program Level.
  - 10 Audio technical personnel/examinations staff
  - 8 video technical personnel/examinations staff
  - 10 support personnel (administrative and IT-type support)
  - **7 image analysis technical personnel/examinations staff**
    - All examiner personnel identified in laboratory paperwork as “Forensic Examiner.”
    - Formal US Government job title for image analysis examiners is “Photographic Technologist”.
  - Supervisory Specialist – Image & Video – manage day-to-day forensic operations
  - Two Senior Scientists co-located with FAVIAU, but organisationally out of Section Front Office (above Unit). Senior Levels responsible for highest level of case work, liaison, instruction to field, active solicitation of state of the art developments in Area of Interest (AOI) for laboratory, as well as for FBI at large and US government.
  - Examinations staff responsible for case work (including court testimony), instruction to field, and awareness of state of the art developments in AOI for future application in laboratory.

Capabilities:

- Facial image comparison – “for information or intelligence” and “for court”.
  - (5 trained and 2 trainees) staff involved in facial image comparisons.
  - Created and Run **Facial Comparison and Identification course** (1 week).
- Digital Source Analysis (Identifying what images come from what cameras/sensors)
- Facial recognition system development and use case identification
United States of America – Federal Bureau of Investigation - Criminal Justice Information Services (CJIS) – Facial Analysis, Comparison and Evaluation (FACE) Services Unit

Falls under Biometric Services Section - headed by a Unit Chief.

Structure:
- FBI Director
- Deputy Director
- Executive Assistant Director of Science and Technology Branch
  Criminal Justice Information Services (CJIS) Division
  Biometric Services Section (BSS)
  Facial Analysis, Comparison and Evaluation Services Unit (FACE)

Functions:
- Performs facial recognition searches on behalf of FBI Special Agents, Intelligence Analysts, and other FBI Investigative Personnel as part of an active case.
- Analysis, comparison, and evaluation, using morphological analysis, of galleries resulting from a FR search in order to send the most likely candidate, when one is found, as an investigative lead, NOT positive identification [not forensic].
- Text searches of internal and external databases are also performed in search of better quality photographs.
- Photo Line-up support is also provided.

History:
- The Unit was formed as a result of specific requests from the FBI field offices. Trade studies, in support of NGI, resulted in positive value added information in cases of those who were wanted. The FACE Services Unit became operational, using a phased approach, on August 5, 2011.

Staff (39 approved – 33 current : Operating 24/5):
- Unit Chief – Responsible for adherence to all laws and regulations; strategic planning; human resource allocation; and overall management at the Program Level.
  1 Management and Program Assistant
  2 Supervisory Management and Program Analysts/Project Managers
  1 Operations Manager

- Supervisory Management and Program Analyst/Project Manager – Responsible for business line development; policy and procedure development; liaison, communication, and collaboration with internal and external partners; marketing and educating the service; document development/management; reporting; legal related research; budgetary issues; etc.
  7 Management and Program Analysts assigned
  1 Management and Program Assistant

- Supervisory Management and Program Analyst/Project Manager for the new Scars, Marks, and Tattoo Business Line.
  1 Management and Program Analyst

- Operations Manager – Responsible for overall operations to include training,
  3 Supervisory Biometric Images Specialists (days, nights, midnights)
  11 (+6 in training) Biometric Images Specialists (days, nights, midnights) – responsible for conducting facial recognition checks and facial image comparisons.
Capabilities:
Facial image comparison - for “investigative leads only”, not for court.
Staff as identified above.

Facial recognition systems utilised
Internal: FBI’s Next Generation Identification Pilot
External: Department of State VISA photos, 4 State Department of Motor
Vehicles FR systems, Department of Defense Biometric Identity Management
Agency Automated Biometric Information System.
United States of America - New York Police Department (NYPD) – Real Time Crime Centre – Facial Identification Section

Falls under Real Time Crime Centre - headed by an Inspector.

Structure:
New York Police
  Real Time Crime Centre (RTCC)
  Facial Identification Section (FIS)

Functions:
Facial Comparison (for intelligence)
Facial Recognition
Image correction and enhancement for facial recognition.

History:
Formed 2011
Using facial recognition systems since 2011
Undertaking facial image comparisons since October 2011 (Investigative lead only).

Staff (8):
Team leader Sergeant Edwin Coello – Responsible for all facial comparisons including policy and procedures development and adherence, training, facial recognition system use and development, and liaison.
1 Principal – responsible for image quality control and administration.
4 Police Detectives – Responsible for facial recognition, facial image comparisons. Have different subject matter expertise such as image correction and enhancement (Adobe Photoshop), video analysis, sketch artist and face recognition.
2 Facial Recognition Vendor Software Engineers – Maintaining and developing the system as part of contract.

Capabilities:
Facial image comparison - for “investigative lead” only.
  5 staff involved in facial image comparisons.
  Currently in the process of reviewing procedures.

Facial recognition system
  5 users as above.
  2 vendor staff as support and development.
Image enhancement and correction (Adobe Photoshop; Apple Final Cut Pro, Animetrics 3D software). Also face sketching capability (forensic artist).
  5 users as above.
Canada - Royal Canadian Mounted Police (RCMP) - Canadian Criminal Real Time Identification Services (CCRTIS) – Biometric Business Solutions (BBS)

Biometric Business Solutions - headed by a Director.

Structure:
Royal Canadian Mounted Police
National Police Service
Forensic Science and Identification Services (FS&IS)
Canadian Criminal Real Time Identification Services (CCRTIS)
Biometric Business Solutions

FS&IS provides a wide range of forensic programs and services to clients in Canada and internationally through forensic science services:

**Canadian Criminal Real Time Identification Services (CCRTIS)** maintains the national repository of fingerprint and criminal record information and is mandated to provide direct operational support to the Canadian law enforcement, criminal justice and public security communities, as well as international partners such as the Federal Bureau of Investigation (FBI) and Interpol, for criminal, civil and immigration purposes. CCRTIS is the national provider of biometric-based criminal record verifications for civil and criminal court purposes as well as the security screening environment for all levels of government and the general public. CCRTIS is the only organisation that can create, update, and maintain criminal record information on the Identification Data Bank contained in CPIC.

**National Police Information Services Advisory Board (NPISAB)** supports law enforcement agencies and enhances public safety via electronic information sharing through the National Police Services Network in a timely and cooperative manner.

**Criminal Records Working Group (CRWG)** provides a consultative forum for discussing CCRTIS policy and business practices relative to criminal records management. The Working Group represents a cross section of Canada’s law enforcement agencies from western, eastern, and central provinces.

Functions:

**Biometric Business Solutions (BBS)**

Comprised of section managers, certification specialists, business solution analysts, IT and Engineer and fingerprint experts, this section responds to client demand for more advanced biometric and identification management services. As well, this unit:

- Manages all LiveScan and CardScan Devices under the Public Safety Anti-Terrorism (PSAT) Program
- Executes RCMP RTID (Real Time Identification) Certification activities of Vendor Biometric Products
- Certifies vendors and agency which interface with the RTID system environment and performs connectivity testing with RTID TEST and PRODUCTION environment
- Architects, new or re-engineers existing biometric solutions that support
CCRTIS automated business processes

- Provides Subject matter expertise on Canadian Biometric data exchange standards to all electronic CCRTIS Contributors
- Coordinates and supports front-end implementation and system integration activities associated to electronic biometric devices/contributors Provides 4th Level System Support to Biometric Vendor System Engineers for all biometric electronic devices that connect to RTID including AFIS, RAFIAS and Transcoder systems
- Develops the National Biometric Roadmap and participating in Research and Development (R&D) Projects which assess new biometric modalities (such as Face Recognition, IRIS, Palm, Voice etc.) and for completing feasibility studies
- Monitors changes to International ANSI/NIST standards and ensure continued compliancy

CCRTIS has very close collaboration with Defence Research and Development Canada (DRDC). DRDC is an agency of the Canadian Department of National Defence, DRDC responds to the scientific and technological needs of the Canadian Forces and to domestic safety and security partners, ensuring they remain scientifically and operationally relevant. This collaborative work actively involves industry, international allies, academia, other government departments and the public safety and national security community.

History:

Biometric Business Solutions
Formed in 2007
Using facial recognition systems since 2008
Undertaking facial image comparisons since 2008

Staff (4):

Headed by Biometric Systems Manager – Responsible for multi-modality R&D Biometric system testing and evaluation through DRDC, Canadian Biometric Roadmap for the Enterprise Network, Real-Time Identification using Hand-Held Device for FingerPrint, Iris and Photo.
Member of Video Technology for National Security (VT4NS) led by CBSA.
Liaison with Other Government Departments (OGD) and Agencies at federal level and FBI & Interpol at international level as well.

Capabilities:

Provide advice to the Canadian government on biometrics around technical and performance testing to support RCMP investigations and for border security in collaboration with DRDC and Canadian Border Protection Services (CBPS).
Canada - Royal Canadian Mounted Police (RCMP) – Forensic Facial Imaging Specialists

Forensic Facial Imaging Specialist role falls under Support Services.

Structure:
There are two Forensic Facial Imaging Specialist within the RCMP one for the East and West Coasts of Canada. Only East coast is currently undertaking FIC work.

Functions:
- Interviewing victims and witnesses of crime to produce composite sketches of suspects
- Assistance in identifying human remains by producing 2 and 3 dimensional facial approximations (reconstructions)
- Age progression of missing persons and fugitives
- Facial comparisons for intelligence, court and extradition purposes (On a regular basis, requests for facial comparison analysis originate from Interpol Ottawa - when suspected criminals are wanted for extradition to Canada or from Canada to other countries and, facial comparison is the only method to confirm identity)
- Training in facial comparison

History:
- In 2002, began completing facial comparison analysis at the request of Interpol Ottawa.
- In 2005 recognising the risk associated with facial comparison and the importance of standardisation in facial comparison, both Forensic Facial Imaging Specialists established the first work protocol in facial comparison.
- In 2011 the protocol have been reviewed by the National Integrated Forensic Identification Service staff and slightly modified, more specifically the expression of conclusion levels.

Staff (2*):
- Specialties in face comparison are not a formal discipline in the RCMP with some imaging and forensic artists undertaking this work.
- Only the East Coast Forensic Facial Imaging Specialist and the Analyst at the National Center for Missing Persons and Unidentified Human Remains are involved in facial comparison in the RCMP.

Capabilities:
- Facial image comparison – “for intelligence and information" and “for court”.
- Training in facial comparison based on facial anatomy, the relation between bone structure and facial soft tissues and aging process. RCMP train regional Canadian police in facial comparisons and verifications; and provide specialist training for surveillance teams.
- Facial reconstruction.
- Knowledge and experience working with Adobe Photoshop to complete the facial comparison analysis.
Canada - Canadian Border Services Agency (CBSA) – Video Surveillance and Biometrics Section

Falls under Science and Engineering Directorate.

Structure:

Canadian Border Services Agency
Video Surveillance and Biometrics Section

Functions:

Canadian focus for facial recognition is for applied science and technology outputs to address capability gaps. This includes:

- Facial Recognition Systems testing and performance evaluation for realtime for practical border applications.
- Assessing soft biometrics to track persons of interest across multiple video feeds.
- Looking at better ways to visual detection and tracking data.
- International liaison on facial recognition evaluation and testing.

CBSA has very close collaboration with the Center for Security Sciences (CSS) of the Defence Research and Development Canada (DRDC) who manages research portfolios related to Safety and Security in Canada and provides funding for Canadian federal departments to address technological gaps.

Along with RCMP, CBSA is one of several agencies within the Minister of Public Safety and Security (PS).

Staff (classified):

- Headed by Senior Research Scientist

Capabilities:

Facial recognition systems

- Facial Recognition Systems testing and performance evaluation using Video-Analytics Platform and Testbed (VAP/VAT) for realtime for practical border applications under a number of different degrees of environmental and subject difficulty.
- Assessing methods to triage possible detections by systems and humans, including soft biometrics to track persons of interest to assist investigations.

Further details in classified version of report.