SUMMARY OF THE 1998
NIST FINGERPRINT DATA INTERCHANGE WORKSHOP

On September 22-24, 1998, the National Institute of Standards and Technology (NIST) in cooperation with the Criminal Justice Information Services (CJIS) division's Advanced Technologies Unit (ATU) of the Federal Bureau of Investigation (FBI) sponsored the Fingerprint Data Interchange Workshop. The workshop was held at NIST's headquarters in Gaithersburg, MD. There were 180 registered participants representing ten countries, nine federal agencies, 24 states, and numerous local agencies and private companies.

The purpose for convening the workshop was to review the American National Standards Institute (ANSI) standard titled "Data Format for the Interchange of Fingerprint Information" (ANSI/NIST-CSL 1-1993). This review was intended to perform maintenance on the current version of the Standard and to discuss the incorporation of new ideas and technologies into future versions. After opening remarks were presented, selected implementations were reviewed. Existing shortcomings associated with the standard were presented, and potential solutions were identified and discussed. As a result of the workshop, two new Type-1 record fields were developed, three additional record types were created, and recommendations for future technology enhancements to the standard were offered. These recommendations included data security measures and a description of a series of steps to be followed in order to convert the ANSI standard to an International Standards Organization (ISO) standard. The remainder of this report provides a summary of each major topic discussed during the workshop.

Opening Remarks

Shukri Wakid, director of NIST's Information Technology Laboratory (ITL) presented opening remarks at the workshop. He emphasized the need for Automated Fingerprint Identification System (AFIS) and livescan vendors to work together to capitalize on the use of the fingerprint biometric for both identification and verification applications. He also predicted that in the future, digital signatures including the Digital Signature Standard (DSS), the Rivest-Shamir-Adelman (RSA) algorithm, and elliptical encryption methods would be an important part of the fingerprint capture and identification process. Doug Domin, the FBI's Deputy Assistant Director of Operations in West Virginia, followed Wakid and echoed his comments on the need for continued cooperation between the AFIS and livescan vendors. Domin also highlighted the progress of the major FBI projects to be deployed within the next ten months. These include the November 1998 start of the National Instant Criminal Background Check System to support the Brady Handgun Violence Prevention Act of 1993. Also included are the July 99 online start of the Integrated Automated Fingerprint Identification System (IAFIS), and the July 99 online start of the National Crime Information Center-2000 (NCIC-2000) system. For all of these efforts, interoperability and transmission standards are required. His concluding remarks addressed the fact that the FBI is collaborating with West Virginia University on biometrics R&D and other forensic topics.

History of the ANSI/NIST Standard

Before discussing specific items relating to the Standard, Tom Roberts of the FBI summarized the history of the development of Fingerprint Data Exchange standards. He presented a short review of the structure and use of the image-based fingerprint standard approved in 1993 and the mugshot addendum approved in 1997.

User Experiences Panel

Six different agencies discussed their experiences with implementing the standard. Brian O'Riordan of the UK's Police Information Technology Organization (PITO) stated that the standard had provided the UK's operation with specific rules for encoding information items. These items had previously been encoded using one of many different alternatives. Of the several recommendations he presented, the one of primary importance was that backward compatibility be retained.

Speaking for the FBI, Tom Roberts described the Electronic Fingerprint Image Print Server (EFIPS) that is currently used to supply fingerprint cards to the IAFIS. These cards are generated from electronic images transmitted to the FBI. He went on to explain that the FBI's IAFIS is based on the use of a program of standards and specifications. The Type-1 and Type-4 records as defined by the standard, have been implemented. Image compression is done in accordance with the Wavelet Scalar Quantization (WSQ) algorithm that was adopted during the development of the 1993 data exchange standard. The user-defined Type-2 record is described and specified by the current FBI Electronic Fingerprint Transmission Specification (EFTS). The Image Quality Specification (IQS) addressing fingerprint imaging equipment components is included as an appendix to the EFTS. This version of the EFTS and future versions shall all retain backward compatibility.

Larry Wilke presented a summary of the AFIS and livescan equipment operating in North Carolina. Challenges faced with EFIPS submissions were outlined including the need to upgrade to Version 6.2 of the EFTS. Mike Lesco described similar problems that are faced in Texas and their need to upgrade to Version 6.2 of the EFTS. In addition to live scan equipment, Texas also has two different AFIS vendors in the state.

Jack Meagher from New York outlined the state's workload processing priorities and their version of the Type-2 record that contains the FBI's EFTS descriptions for fields. He also stated that one of NY's goals is vendor independence, so that any vendor wanting to do business with the state must interface with existing booking stations.

Isam Saleh concluded the panel discussion by presenting an overview of Ohio's workload and problems encountered with interfacing different vendors' AFIS and livescan equipment. The use of the ANSI/NIST Standard provided solutions to their data exchange problems between local and state offices. Next year Ohio will also be using the FBI's EFIPS for submitting transactions.

A brief question and answer period concluded this implementation panel discussion. This was followed by a technical session led by Mike McCabe to address specific topics contained in the ANSI/NIST standard. He began the session by presenting an overview of the procedures or steps to be followed during the development of an ANSI standard. After receiving ANSI approval for

a standard, the standard must be reviewed every five years and a decision made to reaffirm, modify, or withdraw the standard. This workshop is the first step in the review process.

Version of the Standard

During the planning of the workshop, a ground rule was established such that any modifications to or a new version of the ANSI/NIST Standard created shall be backward compatible. Existing implementations would not require upgrades to retain the current operational capabilities. However, use of modifications developed and new features created during the workshop will probably require system upgrades. The version/revision number of the standard being used is contained in field 1.02. Currently, the value for this field is "0200". The new version/revision to reflect changes and additions will be "0300".

Domain Name Field 1.13 (DOM)

With the exception of the record length and the IDC fields, the Type-2 record contains all user-defined textual fields and descriptions. Many agencies in the U.S. adhere to the FBI EFTS field definitions. As additional fields are required by specific agencies, these user-specific field tags have been registered and reserved with the FBI's ATU. Use of this domain approach for uniquely identifying field contents, avoids tag numbers with multiple definitions. However, there are implementation domains that do not strictly adhere to the EFTS. For example, the UK and Interpol have developed their own Type-2 record implementations tailored for their communities. As a solution to this situation, a proposal was made for the creation of an optional field to indicate the source or domain of the Type-2 implementation. After considerable discussion, consensus was achieved to create a new Domain Name Field 1.13 (DOM). As an optional field, if present, it shall appear only once in a transaction and shall contain the Domain Name. An optional second subfield separated by the {US} character may be present to indicate a unique version of the implementation. For example, the use of the FBI's implementation may appear as "1.13:EFTS{US}06R2" to indicate the use of the current version 06R2. Responsibility for the registry and maintenance of domain names was left unresolved. However, responsibility for maintenance of the field tags and meanings within a domain was assigned to the owner of each domain.

Date & Time Field 1.14 (GMT)

The 1993 version of the standard describes the format to be used to contain the date in Field 1.05. It also states that the "complete date shall not exceed the current date." A problem may occur when a transaction is submitted to an agency located several time zones away. For example, a query submitted from California to Washington, DC crosses three time zones. If the query is submitted toward the end of the day, it is possible that the return reply from an eastern time zone may have a date that is one day later than the current date in California. To remedy this potential problem, a proposal was submitted to eliminate the restrictive wording regarding the date, and optionally reference the date and time in terms of universal Greenwich Mean Time (GMT). Field 1.14 will be added to the standard to contain the GMT. It shall be an optional field. If used, this field shall concatenate the date with the GMT and conclude with a "Z" using the form of "CCYYMMDDHHMMSSZ{GS}".

Priority Field 1.06 (PRY)

This optional field designates the urgency of a transaction for which a response is desired. Currently, the range of values is from "1" (highest priority) to "4" (lowest priority). The default value is "4" if the field is not present in the transaction. A proposal was made and consensus achieved to expand the priority range to allow for nine (9) levels of priority with a "1" being the most urgent priority and the default value being user-defined. The justification for this was to protect AFIS systems from user saturation of high priority transactions.

Field Number Lengths

When the current version of the standard was developed, it was believed that the tag numbers for Type-1, and Type-9 records would require no more than two digits to contain 99 fields and that the Type-2 record would require no more than three digits for 999 fields. However, due to the manner agencies have already assigned tag numbers to fields, these numeric limitations are no longer practical. After a discussion, consensus was achieved to relax the existing numeric restrictions on the tag length. All of the digits between the "." and the ":" shall be interpreted as an unsigned integer field number. This implies that a field number of "2.000000123:" is equivalent to "2.123:". It was further agreed that all tagged field numbers would be limited to a maximum of nine digits.

Ordering of Fields

A proposal was made to eliminate the requirement in Section 6.1 that requires fields appearing in each Type-1, Type-2, Type-9 and Type-10 record to be numerically ordered. It was agreed that the ordering restriction for the tagged fields could be eliminated, provided that the record length and IDC fields remain as the first two fields. Field ordering would still be required for fixed binary fields belonging to image records (Type-3 through Type-8 records).

Information Separators

The information separators ({US}, {RS}, {GS}, and {FS}) are used to separate data items. Currently, only one separator may be present between any two data items. Adjacent separator combinations such as "{US}{RS}" are illegal. This restriction has caused implementation problems when data fields or items in a transaction were missing or optional. This current rule forces the insertion of dummy data. A proposal was submitted to eliminate this restriction. After a discussion period, the general conclusion reached was that elimination of this restriction should not pose problems for existing systems. Consensus for eliminating the separator restriction was achieved. It was also agreed that a field requiring "n" data items shall also be required to contain "n-1" separator characters, as in the case of parallel arrays.

Limit on Type-2 Records

According to Table 2 in the current version of the Standard, only one Type-2 logical record is allowed for any transaction. Since the creation of the 1993 standard, applications have been developed that require multiple Type-2 records. The exchange of rap sheets is an example of

such an application. After some discussion a proposal was submitted and passed to adjust the wording in the Standard to imply that the table record limits are exemplary and specific applications should dictate the maximum number of Type-2 records that may be present.

Limit on IDC Numbers

The current version of the Standard limits the range of the Image Designation Character (IDC) numbers from 0-17. As new record types are appearing for imagery other than tenprint fingerprints, the range of IDC numbers must be expanded. A proposal was made and passed to eliminate the restriction of IDC numbers.

Merging of Standards

In 1997, an addendum to the ANSI/NIST-CLS 1-1993 standard that addressed Mugshots (facial images), and Scars, Marks, and Tattoos (SMT) was developed and approved by ANSI. The addendum, that was based on the 1993 standard, created a tagged field Type-10 record used for formatting both descriptive and image information data in the same record type. Currently, this addendum titled Data Format for the Interchange of Fingerprint, Facial, & SMT Information is an ANSI standard with the designation of ANSI/NIST-ITL 1a-1997. A proposal was made and accepted to merge the fingerprint standard and its mugshot addendum into a single standard and document.

International Character Sets

Mike Rubinfeld of NIST highlighted aspects of using common character sets for the standard's textual fields. Although the ISO Latin-1 character set would accommodate many languages, it still is not inclusive enough. The 16-bit ISO/IEC Unicode is a possible solution but requires twice the storage. An ad hoc group of volunteers was appointed to study the problem. Members of this group are Bill Ledeen, Peter Higgins, Wally Briefs, Frederick Biarnes, Bonny Scheier, and Isam Saleh. Some of the group met with Rubinfeld after the workshop was over and discussed some basic ideas. A written report of the approaches discussed will be generated.

Type of Transaction Considerations

Scott Blanchard, from the Michigan State Police, gave a presentation on the types of transactions to be used and administrative aspects to be considered when submitting transactions to remote systems and agencies. Several issues were discussed including the amount of information required to be present in the transaction, and the party responsible for performing verifications of candidate hits. A survey was presented for the users to complete and return to NIST. No Standard's proposals or recommendations were presented during this session.

Rap Sheets

John Loverude from the Illinois State Police presented an overview of the use of the ANSI/NIST Standard for the rap sheet application. Multiple Type-2 records for multi-state offenses will be

merged into a single file. At this time it is anticipated that five states will participate in an exchange pilot in the spring of 1999.

Gray Backgrounds for Mugshots

Mike Rubinfeld began the second day of the workshop by presenting the results of an experiment performed at NIST. This work studied the relationships of different digital cameras, lighting, and clothes color on the captured gray background used in mugshots. Calibrated test samples of varying shades of gray were captured and their red, green, and blue (RGB) component values measured, recorded, and analyzed. One conclusion developed from the study is that equal values of RGB components from the recorded background are hard to achieve. It was also determined that recorded 8-bit values for the RGB components of an 18% gray background will be in the range of 105 to 135 depending on the type of camera used, lighting, etc. When capturing mugshots, a neutral gray target such as the Kodak gray card should be used as part of the calibration procedure.

Remote Submission of Latent Prints

Tom Hopper from the FBI's ATU discussed the status of the project for the remote submission of latent fingerprints. He began with a historical perspective in which he credited Ray Moore with the original concepts of characteristic and minutiae encoding as described by the ANSI/NIST-CSL 1-1993. IAFIS operation is scheduled for July 1999. Submission of remote latent searches is targeted for the end of 1999. The goal of the project will be to perform fully reliable latent searches in a vendor-neutral, lights-out environment. Hopper proposed the use of the Type-9 logical record to accomplish this.

The first 12 fields of the Type-9 record in the 1993 Standard, describe the encoding of the minutiae data. Field 4 contains an "S" if the minutiae data is encoded in accordance with the manner described in the Standard. Otherwise a "U" will be used to indicate the minutiae data is encoded in a user or vendor-specific manner. Hopper's approach proposes to partition the Type-9 record into registered blocks of tagged fields reserved for each specific vendor's feature vector. The tagged fields would contain the minutiae and other characteristic data encoded in a manner unique to the AFIS of the particular vendor owning that block of fields. At this time, Lockheed Martin Corporation (LMC), Cogent Systems Inc, and Printrak International have submitted their requirements for tagged fields that describe the feature data that each respective system needs to properly search their system's database. Since the meeting, Sagem-Morpho has also responded with their requirements. Only one major vendor has yet to respond with a list of their required data fields.

A discussion comparing the relative merits of submitting images for remote latent searches, versus submitting feature-based data for searches followed. The general conclusion was that for a few latent prints, the images would be appropriate, but for the majority of work, feature-based data would provide better performance.

The discussion then turned to progress in research. Hopper stated that research and development efforts were taking place at NIST. These efforts are aimed at exploring better minutiae detection

methods, improving the reliability of encoding features, and providing latent examiners with effective, efficient, and quality results. As in the past, NIST results will be made readily available to everyone who is interested.

Steve Meagher of the FBI's Latent Fingerprint Section (LFPS) concluded the discussion stating that an important piece of data missing is a reasonable set of test data to study the performance of systems. He went on to say that the FBI and LMC has established a latent print test database consisting of four data sets with 300 latent prints and their rolled mates. Minutiae from this database were not detected by computerized means. Experienced latent examiners carefully selected the minutiae from the fingerprint images. This database can be used for testing algorithms and dissimilar systems to determine if the appropriate performance and accuracy results are achieved. NIST has agreed to publish these data sets in a CD format for testing by vendors and others as soon as the data is released from the FBI's IAFIS program office.

Image Record Formats

Mike McCabe began this session by reviewing the currently available image record formats and field descriptions contained in the 1993 Standard. He pointed out that the Type-3 through Type-6 image records were fixed format and contained fixed length fields used to exchange fingerprint image data. The Type-7 image record was intended to contain image data not specified elsewhere in the standard. Its format was strictly user-defined. In 1997, the Type-10 tagged field record for Mugshots and Scar, Mark, and Tattoo (SMT) information was added as an addendum to the standard. This signaled a break from the fixed format image record concept previously specified. Use of the variable size tagged fields to contain the data allows both ASCII textual data and binary image data to be contained in the same record.

This tagged field format can also be used to exchange fingerprint data. As the need for higher resolution images becomes more apparent, this tagged field concept can be used for exchanging image data scanned at resolutions exceeding 19.69 pixels per millimeter (ppmm) or 500 pixels per inch (ppi). To accomplish this, two new record types were proposed. The first record (Type-13) would be used for the exchange of latent image data. A second record (Type-14) would be used to exchange known, rolled or plain impression images. Similar fields would be present in each record type to identify the image type, resolution, color depth, etc. A recommendation was also presented to leave record Type-3 through Type-8 as currently specified, including scanning resolution.

The final point brought out during this session was that the ANSI/NIST Standard fingerprint file structure together with the tagged field format record could provide a means of exchanging various other types of forensic data using a single common format and structure. Suggestions have already been made for developing additional tagged field image record types covering crime scene photos, ballistic images, iris scans, and booking station voice prints. Such record types would be developed as interest dictated, and time and resources became available. Use of this standard for other applications was met with very strong opinions, both for and against the idea. The argument against the recommendation was that fingerprint practitioners should not be making decisions on disciplines outside their expertise. In response to this, it was suggested that a series of related standards and records could be developed by experts involved in those specific

disciplines without the representation of fingerprint personnel. Many of the participants believed that the forensic community could benefit from a common structure for exchanging images.

Latent Print Discussion Panel

The panel consisted of Ed German from the Army Crime Lab, Brian O'Riordon from the UK's PITO, Mike Fitzpatrick from the Illinois State Police (ISP), and was chaired by Charles Wilson from NIST. Ed German presented the Technical Working Group on Friction Ridge Analysis, Study and Technology (TWGFAST) position in which he described the three levels of fingerprint analysis to be considered. For the first two levels of pattern identification and minutiae detection, a scanning rate of 19.69 ppmm (500 ppi) is quite adequate. Increasing the scan rate will not improve results acquired from the AFIS matching. However, level 3 analysis of pores, ridge edges, and details require data capture at a higher scanning rate. Level 3 analysis is required when traditional minutiae are not available for examination. TWGFAST recommended that the scanning resolution be raised to 47.24 ppmm (1200 ppi) for the existing Type-4 records and that a new 47.24 ppmm (1200 ppi) record format be defined for latent images. Decreasing cost of storage and increasing transmission rates are the justifications for this proposed 6-fold increase in captured data. All new systems acquired in the future would be required to have a resolution of 47.24 ppmm (1200 ppi) although existing systems would be 'grandfathered' at 19.69 ppmm (500 ppi).

Brian O'Riordan stated that the current Standard facilitates the majority of fingerprint work, although a level 3 analysis does requires a 39.37 ppmm (1000 ppi) scanning resolution. He recommended that the Type-4 record remain unchanged and that a new optional high resolution record be created to accommodate level 3 analysis. He also recommended that investigations be conducted aimed at determining requirements for level 3 details.

Mike Fitzpatrick supports the TWGFAST position but disagrees with the migration plan. It is also his opinion that Level 3 poroscopy analysis may require even a higher scanning resolution than 47.24 ppmm (1200 ppi). He recommended that the Type-4 and Type-7 records remain unchanged and that new higher resolution fingerprint image records be defined. He further proposed that image quality specifications be established for the higher resolution records and tests be designed and performed to observe the effects of the higher resolution on the WSQ compression algorithm.

A discussion period followed the presentations. Due to a previous commitment, Steve Meagher from the FBI replaced Ed German for the remainder of this session. Questions and comments posed addressed different aspects of a higher scanning resolution for fingerprint images. The proposal recommended by TWGFAST was to increase the scanning resolution for tenprint and latent work to 47.24 ppmm (1200 ppi). It became apparent that there was little support for this recommendation. Therefore, Wilson proposed the motion to retain the Type-4 record as currently specified with no increase to the current scanning resolution of 19.69 ppmm (500 ppi). This motion was passed by a large majority of the workshop attendees. Wilson then proposed the creation of a new high resolution Type-13 record for latent work and a high resolution Type-14 record for tenprint image records. No scanning resolution was specified for either record type. The scanning resolution used would be specified in one or more fields within the record itself.

This motion was also passed by a large majority of attendees. The exact tagged data fields required for the records will be determined after the workshop and put in the draft of the standard that will be circulated for comment. It was pointed out that the decisions made at this workshop would be used to update the next draft of the standard. That draft shall be circulated for an official canvass vote before it receives ANSI approval as a standard. Some additional discussion regarding the value to be used for the higher resolution followed. The session ended when everyone agreed that, at this time, agreement could not be reached on the value to be used for the higher resolution.

Palm Print Discussion Panel

The panel consisted of Ken Moses who chaired the panel, Dave Larabee from the United States Postal Service (USPS), Steve Meagher from the FBI, and Mike Fitzpatrick from the ISP. Moses began by emphasizing the importance of palm prints in criminal investigations. In 1996, the International Association for Identification (IAI) approved a standard for palm print capture. As this has become an industry de facto standard, he proposed to incorporate it as part of the ANSI fingerprint standard. The IAI standard specifies the continuous capture of the 13.97 cm (5.5 inch) wide by 20.32 cm (8.0 inch) long area from the heel of the palm to the fingertips. The scan resolution was set at 19.69 ppmm (500 ppi) and the pixels are to be recorded to 8 bits of grayscale.

Larabee described the parts of the palm, emphasizing the importance of the "writers palm" which is the 4.45 cm (1.75 inch) by 12.7 cm (5.0 inch) area on the side of each palm opposite the thumb. In a study performed, 60% of all cases had the writer's palm as the most significant factor. He also stated that the continuous scan portion of the IAI standard was a point of contention. Some vendors want to meet this requirement by using two separate scans of the palm and overlapping them to form a single image.

Meagher presented the TWGFAST recommendations for palm prints. TWGFAST views palm prints as a latent application and proposes that the ANSI standard define a new record type for the palm print. The scanning resolution should be 47.24 ppmm (1200 ppi) with each pixel quantized to an 8-bit grayscale value. The WSQ algorithm, using a 15:1 compression ratio, should be used to store the data obtained from the FBI/IAI palm print card.

Fitzpatrick basically supported the IAI standard. He recommended that the palm print have its own record types for both a 19.69 ppmm (500 ppi) scan rate and also a higher scan rate. He stated that palm print standards were required to direct the vendors and to represent user needs.

In the discussion that followed, the main issues debated were the maximum and minimum sizes of the palm prints and whether the palm needed to be continuously scanned or if two scans could be used and combined to appear as a continuous scan. The proposal that was eventually adopted called for the addition of a new logical record (Type-15) for exchanging palm print information. The new tagged image record would be comprised of a full palm print image and a writer's palm print image. Each image shall have a minimum scanning resolution of 19.69 ppmm (500 ppi). The Type-15 record would also provide fields for specifying increased resolution. The maximum dimensions of the full palm image shall be 13.97 cm x 20.32 cm (5.5 in x 8.0 in), and the writers

palm shall be no larger than 4.45 cm x 12.7 cm (1.75" by 5.0"). The content of the images will dictate the minimum size. The exact tagged data fields required for the palm print record will be determined after the workshop and put in the draft of the standard to be circulated for comment.

IAFIS Issues

Tom Roberts presented an overview and current status of the FBI's IAFIS program. He reviewed the goals of the program that included the development of an infrastructure and standards that would enable a two-hour turnaround for electronic criminal ten-print submissions, add a latent capability, and improve digital image quality. The ANSI/NIST data exchange standard, the Electronic Fingerprint Transmission Standard (EFTS) including its Image Quality Specification (IQS) appendix, and the Wavelet Scalar Quantization (WSQ) specification are the three main documents being used to accomplish the program goals. Roberts then described the five core IAFIS services to be offered. A brief question and answer period followed.

Digital Signatures

Jim Foti from NIST started the final day of the workshop by presenting a tutorial on securing fingerprint and booking station data with digital signatures. He explained the need for digital signatures and their basic operation. A method of applying them to the exchange and storage of fingerprint and other booking station data was also described. He concluded his presentation by giving an overview of the applications of digital signatures and the products implementing digital signatures. As this was designed as an informational tutorial, there were no recommendations or proposals submitted at this time regarding the application of digital signatures and fingerprints. However, the topic will be studied and recommendations may eventually be proposed.

International Standards Considerations

Michael Hogan from NIST gave the final presentation of the workshop. He provided an overview of international standards issues that must be considered in order to take the current ANSI/NIST fingerprint data exchange standard and convert it to an ISO standard. He highlighted the political consideration and obstacles to overcome during the fast track process of converting the ANSI standard to an ISO standard.

Conclusion

Major accomplishments of the workshop included the use and creation of Domain Name Field 1.13, and the Date & Time Field 1.14 in terms of Greenwich Mean Time. Minor fixes for other issues concerning the standard were discussed and consensus for solutions achieved. Tagged record formats were introduced for processing latent, tenprint, and palm print image records. These new record types specify a minimum of 19.69 ppmm (500 ppi) with a mechanism available to specify the use of higher scan resolutions.

In order to arrive at a single numeric target value for a higher scanning resolution, Dave Gavin from Texas shall bring the question of developing such a recommendation for a specific higher

scanning resolution to the November meeting of the FBI's Advisory Policy Board (APB). Work will also be initiated for the application of digital signatures at booking stations and for stored identification data. The possibility of converting the ANSI standard to an ISO standard will be studied which will include the use of international character sets for textual data. Finally, the fingerprint and mugshot standards will be merged and represented as a single document in the future. The decisions made and agreements reached during this workshop will be incorporated into the 1993 standard and the first draft of the next version of the standard will be available for comment early in 1999.