



High-Priority Information Technology Needs for Law Enforcement

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PRIORITY
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NEEDS INITIATIVE

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Preface

The National Institute of Justice (NIJ) is tasked to serve as the national focal point for work on criminal justice technology by the Homeland Security Act of 2002 (Pub. L. 107-296) and to conduct programs to “improve the safety and effectiveness of law enforcement technology and improve access to such technology by Federal, State, and local law enforcement agencies” (§232[a][2]). To carry out this mission, NIJ pursues a wide range of activities, from identifying practitioners’ needs to assessing available technology solutions; providing information, liaison, and outreach to enable matching technology applications to priority needs; engaging in such community efforts as guides and standards development; to sponsoring research, development, testing, and engineering across a large number of diverse technology portfolios.

To help NIJ accomplish its mission, the RAND Corporation Information and Geospatial Technologies Center, which is part of NIJ’s National Law Enforcement and Corrections Technology Center system, has been conducting strategic planning activities to support NIJ in the area of information technology (IT), collecting and analyzing data on law enforcement needs and potential solutions through technology assessment studies, extensive outreach and liaison activities, and subject matter expert panels. This report summarizes the center’s studies, presents a full list of priority IT needs for law enforcement, and presents larger themes derived from groups of related needs. It should be of interest to law enforcement agencies, NIJ, and other funders and developers for the law enforcement community.

The RAND Safety and Justice Program

The research reported here was conducted in the RAND Safety and Justice Program, which addresses all aspects of public safety and the criminal justice system, including violence, policing, corrections, courts and criminal law, substance abuse, occupational safety, and public integrity. Program research is supported by government agencies, foundations, and the private sector.

This program is part of RAND Justice, Infrastructure, and Environment, a division of the RAND Corporation dedicated to improving policy and decisionmaking in a wide range of policy domains, including civil and criminal justice, infrastructure protection and homeland security, transportation and energy policy, and environmental and natural resource policy.

Questions or comments about this report should be sent to the project leader, John Hollywood (John_Hollywood@rand.org). For more information about the Safety and Justice Program, see <http://www.rand.org/safety-justice> or contact the director at sj@rand.org.

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Summary

The National Institute of Justice (NIJ) has a unique position in the federal government. NIJ is tasked to serve as the national focal point for work on criminal justice technology by the Homeland Security Act of 2002 and to conduct programs to “improve the safety and effectiveness of law enforcement technology and improve access to such technology by Federal, State, and local law enforcement agencies.” To carry out this mission, NIJ pursues a wide range of activities, from identifying practitioners’ needs to assessing available technology solutions; providing information, liaison, and outreach to enable matching technology applications to priority needs; engaging in such community efforts as guides and standards development; to sponsoring research, development, testing, and evaluation (RDT&E) across a large number of diverse technology portfolios.

Accomplishing NIJ’s mission is complicated by the size and diversity of the community that it serves. The U.S. law enforcement community of practice alone is estimated to contain close to 18,000 agencies, including approximately 12,500 local departments, 3,000 sheriffs’ offices, 50 state agencies, 1,700 special jurisdiction agencies, and 600 “other” (Reaves, 2011). Further, the NIJ budget is small compared to the resources available to technology vendors and other federal agencies that serve the law enforcement community.

This situation requires strategic planning information, both to help NIJ make the best investments to leverage its limited funds and to help the range of technology developers supporting law enforcement better understand the law enforcement community’s needs and priorities. The RAND Corporation Information and Geospatial Technologies Center, which is part of NIJ’s National Law Enforcement and Corrections Technology Center system, has been conducting strategic planning activities to support NIJ in the area of information technology (IT), collecting and analyzing data on law enforcement needs and potential solutions through technology assessment studies, extensive outreach and liaison activities, and subject matter expert panels. IT needs and activities have been identified through the following activities and studies:

- developing a formal characterization (technically, a taxonomy) of criminal justice technologies
- in conjunction with its expert Law Enforcement Advisory Panel (LEAP), developing a set of objectives for law enforcement that technologies need to support
- conducting interviews with representatives of 25 law enforcement agencies about their IT needs (Gordon et al., 2012)

- supporting four technology working groups—expert panels held to identify needs on the topics of information-led policing, geospatial technologies, operations research, and modeling and simulation
- conducting a week-long workshop with the LEAP to identify and prioritize needs whose solution would address pressing operational problems, followed by a virtual panel to further prioritize the needs
- conducting a series of technology assessment studies, including the following:
 - preparing a detailed guide on predictive policing, which is the use of analytical techniques (usually statistical models) to identify promising targets for police intervention to help prevent crime, solve past crime, and identify potential offenders and victims (Perry et al., 2013a). Needs emerging from the study include providing tools that are affordable and easy to use; creating tools that provide additional situational awareness information about recent criminal activity, police activity, and other relevant information in addition to the predictions; and additional research and evaluation on what sorts of interventions best capitalize on different types of predictions.
 - assessing 14 recent geospatial tools funded by NIJ (Wong, Sorensen, and Hollywood, 2014). In addition to providing detailed findings on the tools, the study also identified gaps in how tools are supported to reach maturity, how tools are disseminated, and how easily tools can be integrated into existing systems.
 - preparing a detailed guide on the use of automated license plate readers (LPRs) in law enforcement (Gierlack et al., 2014). The study identified a need for more research on using LPR data for crime analysis purposes, a need for more development of privacy policies, and a need to address technology and policy barriers to sharing LPR data across state lines.
 - developing a model describing how IT and policing activities might work together to produce key policing outcomes, conducting exploratory analyses of a statistical implementation of the model, and describing what would be needed to test relationships between IT investments and outcomes formally (Jackson et al., 2014).
 - examining the interoperability and cost accessibility of records management systems, computer-aided dispatch systems, and other key law enforcement information-sharing systems (Winkelman and Hollywood, unpublished).

The strategic planning recommendations in this report include both general ones covering common themes and prioritized lists of specific needs. In line with the dedicated technology areas of the center, this report focuses on IT-related needs for law enforcement. These needs and themes are intended for technology developers and funders in general, including both NIJ and other organizations. Further, both are intended to be living documents—both are managed in simple databases that are transitioning to RAND’s fiscal year 2014 initiative to capture and prioritize technology needs for the criminal justice community, supporting NIJ.¹

By looking across all the top-ranking needs (roughly equivalent to the top third), the center identified 11 crosscutting themes in total. These themes themselves are further grouped into just three overarching keynotes—a broad need to improve the law enforcement commu-

¹ RAND, the Police Executive Research Forum, RTI International, and the University of Denver are collectively carrying out an activity for NIJ to identify the highest-priority criminal justice technology needs.

nity’s knowledge of technology and practices; a broad need to improve the sharing and use of law enforcement–relevant information; and a broad need to conduct RDT&E on a range of topics. The latter category includes research on both the “nonmateriel” side of technology, including policy and practices, and more traditional technical development. Table S.1 shows a high-level breakdown of all the themes and categories.

Improving the law enforcement community’s knowledge of technology. The center received strong and repeated calls to improve the dissemination of knowledge about technology in general. Specific needs for doing this include having a federally sponsored repository of best practices and technology information; links to technology guides, information, and practice experts; and links to (or centralized repositories of) free and inexpensive tools. There is also a strong desire to work with law enforcement associations to better disseminate practices and raise technology awareness, given that agencies reported getting most of their technology information (other than sales information) from such groups. Note that there have been a wide range of efforts to disseminate technology information to law enforcement practitioners. However, this theme—along with other needs that call for technologies or information that already exist—reflects needs that have been unmet to date, even given existing efforts.

The number and extent of criminal justice technology information-dissemination efforts already under way call for strategic coordination rather than entirely new efforts. We recommend designating a federal (or federally sponsored) coordinator for technology-related outreach to work with the various offices already involved to develop and monitor a dissemination strategy capturing who will do what, for whom, and when, along with dissemination metrics, to assist practitioners in learning about and using key technologies and associated methods. Key parts of the strategy will include the development and maintenance of the “repository” (probably assembled from multiple existing resources) and building relationships with both practitioner and developer associations. The “strategy” is meant to be a living schedule showing what dissemination activities are going on, not a one-time paper document that is unlikely to have a real-world impact.

Improving the sharing and use of law enforcement information. The second-strongest theme from across the needs was to improve the sharing of law enforcement–related

Table S.1
Summary of Themes in Law Enforcement Needs

Keynote	Theme
Improve the law enforcement community’s knowledge of technology and practices	Improve the law enforcement community’s knowledge of technology and technology practices Improve the dissemination of best practices related to technology management and process improvement
Improve the sharing and use of law enforcement information	Improve sharing Improve display and use
Recognize the need for other technology RDT&E	Improve health systems Improve mechanisms to communicate with the public Improve privacy, security, and civil rights policies Improve the affordability of technology Improve practices to reduce crime Improve major event response technology Improve deployable sensors

information across multiple agencies and systems. The center itself has conducted a study on key law enforcement information-sharing systems and mechanisms (e.g., Winkelman and Hollywood, unpublished) and has seen and discussed this topic many times across its interviews, site visits, and conferences. We have a number of observations:

- First, this is a difficult problem, whether considered technically (there is an enormous amount to be done), organizationally (governance and policy challenges), or commercially (challenges in business models of who pays for it while making it affordable). Figure 3.1 in the body of the report shows that dozens of key research and development elements are still needed to facilitate information-sharing. That said, a great deal of progress has been made by federal-, state-, local-, and association-sponsored efforts that has made information-sharing *possible* for committed agencies and organizations, although far from the default.
- Second, interoperability development efforts to date do have limited coverage and have inconsistencies among them—data-sharing standards with inconsistent treatment of similar data elements, for example, or standards that allow too much variation in how to represent data elements. The problems are compounded by having literally dozens of organizations and efforts involved in information-sharing, with limited coordination between them.
- Finally, it is particularly difficult for new agencies seeking interoperability and developers seeking to provide it to learn about using all the available tools and resources.

The number and extent of criminal justice technology information-dissemination efforts already under way also mean that what is needed is strategic coordination rather than entirely new efforts. A federally sponsored coordination role is needed to

- maintain a master list of outstanding needs and corresponding tasks to be done to support law enforcement information-sharing
- capture which information-sharing projects are addressing the required tasks, work with the sponsoring organizations to deconflict efforts if necessary, and advocate for addressing key needs and tasks that are not being addressed
- monitor the information-sharing tasks, updating their status
- capture and disseminate all of the above in an “information-sharing strategic plan”—again, the plan would comprise dynamically managed taxonomies, status descriptions, and schedules rather than be a one-time paper document.

Dissemination efforts for the resulting information-sharing resources and tools to use them (notably the software development kits and tutorials) should be conducted through the coordination and repository functions discussed above. As with technology information dissemination, partnering with associations will be key—especially given that associations are already developing a great deal of material and resources relating to information interoperability.

Directly related to the issue of sharing law enforcement information is the challenge of displaying and using it once received. This challenge gives rise to calls for tools that display tailored *situational awareness* information to law enforcement users at all levels, from the field to commanders. These sorts of displays are often referred to as common operational pictures or dashboards—they typically provide some sort of map overlaid with key information that

users need to support their jobs. The “map” is typically a geospatial map, but in law enforcement, “maps” can include such displays as social networks, time lines, and graphs and charts analyzing crime phenomena as well, depending on what is needed. These tools need to support common operational picture–like displays and drill-down capabilities, tailored to users’ current needs to support and improve their decisionmaking. The center has seen the emergence of dashboards from vendors and individual departments that display information, but this is an area needing additional RDT&E. Although the idea of providing common operational picture–dashboard displays is well-recognized, much work needs to be done to understand what sorts of displays and features might be most useful to practitioners in different roles. The different roles—and corresponding types of displays—would include agency command (discussions have taken place on replacements or major improvements to COMPSTAT, for example), field-level operations, and departmental planners and schedulers.

Providing other technology RDT&E. Finally, the third thematic area presents an array of top needs in a range of different technologies and uses, as shown in Table S.1. Of interest is that many of the needs have to do with calls for nonmateriel deliverables (research, guidance, and training on new processes and techniques) rather than materiel technology deliverables (new tools or products). In summary, there is an overarching need

- for RDT&E to *improve health systems* monitoring and supporting officers’ health, especially mental health
- to support efforts to produce and disseminate guides to *law enforcement’s use of social media*.
- to monitor, support, and help disseminate *model policies concerning cybersecurity, privacy, and civil rights protections* for new technologies, especially surveillance systems (videocameras, automated LPRs, facial recognition, and so on)
- to develop and disseminate guidance on *business and systems acquisition models* that can help agencies field capabilities at lower total cost
- to *expand research and evaluation on practices to reduce crime*, including alternatives to mass stops and arrests, practices to reduce crime from repeat offenders, and practices to reduce high-volume Part I crimes in general²
- to *improve IT and supporting training and policies* for major event response, likely by partnering with the Department of Homeland Security
- to improve (and improve the dissemination of) *deployable sensor systems*, including lightweight body-worn cameras, field biometrics, electronic evidence collection systems, and video surveillance systems.

² Part I crimes are more serious crimes reported to the Federal Bureau of Investigation as part of the Uniform Crime Reporting requirements. They include criminal homicide, forcible rape, robbery, aggravated assault, burglary, larceny/theft (excluding vehicle theft), motor vehicle theft, and arson.

Acknowledgments

We would like to thank the National Institute of Justice staff who have given us their strong support ever since the center was established. We would especially like to thank our project officers and monitors, Steve Schuetz, Bill Ford, and Joel Hunt.

More than 50 RAND staff members and adjunct staff have supported the Information and Geospatial Technologies Center of Excellence in some form, whether as a researcher on one or more studies, an administrator, or a peer reviewer of this or other center reports. Although we cannot name everyone, we would like thank all who contributed to the center's studies.

Finally, we would like to thank the hundreds of expert law enforcement practitioners and developers with whom the center staff have worked over the course the center's activities. These include agency representatives we interviewed directly, developers of NIJ-funded products who let us know about their work, subject matter experts and practitioners who served on one or more of the center's advisory panels, and experts who participated in our online needs survey. We would also like to thank numerous representatives of the International Association of Chiefs of Police, the International Association of Crime Analysis, and the IJIS Institute for both participating in and helping disseminate our studies in various venues. We hope we have accurately reflected your insights and that the findings in this and other center reports are of benefit to the law enforcement community.

Abbreviations

AVL	Automatic Vehicle Locator
ARJIS	Automated Regional Justice Information System
BJA	Bureau of Justice Assistance
CAD	computer-aided dispatch
CA/Inv	Crime Analysis and Investigations
CCTV	closed-circuit television
COE	Center of Excellence
CSI	crime scene investigation
DHS	Department of Homeland Security
FBI	Federal Bureau of Investigation
GeoRSS	Geographically Encoded Objects for Rich Site Summary
GIS	geographic information system
GPS	Global Positioning System
IACA	International Association of Crime Analysts
IACP	International Association of Chiefs of Police
ICT	information and communications technology
IT	information technology
LE	law enforcement
LEAP	Law Enforcement Advisory Panel
LEIM	Law Enforcement Information Management
LPR	license plate reader
MOU	memorandum of understanding
N-DEx	National Data Exchange
NIBRS	National Incident-Based Reporting System

NIJ	National Institute of Justice
NIMS	National Incident Management System
NLECTC	National Law Enforcement and Corrections Technology Center
OJP	Office of Justice Programs
OST	Office of Science and Technology
POP	problem-oriented policing
R&D	research and development
R&E	research and evaluation
RDT&E	research, development, testing, and evaluation
RFID	radio frequency identification
RFP	request for proposal
RMS	records management system
SDK	software development kit
S&T	science and technology
SWOT	strengths, weaknesses, opportunities, and threats
TWG	technology working group
UAV	unmanned aerial vehicle
UCR	Uniform Crime Reporting

Introduction to the National Law Enforcement and Corrections Technology Center Information and Geospatial Technology Center's Strategic Planning Activities

Overview of the Report

The National Institute of Justice (NIJ) has a unique position in the federal government. NIJ (specifically, the NIJ Office of Science and Technology [OST]) is tasked to serve as the national focal point for work on criminal justice technology by the Homeland Security Act of 2002 (Section 232). NIJ OST is also tasked, in the same section, to conduct programs that “improve the safety and effectiveness of law enforcement technology and improve access to such technology by Federal, State, and local law enforcement agencies.” To carry out this mission, NIJ is assigned duties including the following: provide recommendations to the Attorney General; establish and maintain performance standards and certification programs; conduct research, development, testing, and evaluation (RDT&E) on the full range of law enforcement technologies; and provide technology assistance and training materials.

Not surprisingly, NIJ pursues a wide range of activities, from identifying practitioners' needs to assessing available technology solutions; providing information, liaison, and outreach to enable matching technology applications to priority needs; engaging in such community efforts as guides and standards development; and sponsoring RDT&E across a large number of diverse technology portfolios.

Accomplishing NIJ's mission is complicated by the size and diversity of the community that it serves. The U.S. law enforcement community of practice alone is estimated to contain close to 18,000 agencies, including approximately 12,500 local departments, 3,000 sheriffs' offices, 50 state agencies, 1,700 “special jurisdiction agencies,” and 600 other law enforcement organizations. These range in size from one agency with over 35,000 officers (the New York City Police Department) down to numerous agencies with only one full-time officer (Reaves, 2011).

A further complication is that the NIJ budget is small compared to the resources available to technology vendors that serve its community and those of other federal agencies that work in the same or related areas, such as the Department of Homeland Security (DHS), Department of Defense, and Federal Bureau of Investigation (FBI). The core funding of NIJ in 2014 (not counting pass-through and earmarked funds) was only \$40 million, to support the entire criminal justice system (law enforcement, courts, and corrections communities of practice).¹

¹ See Insert 28B, Division B, in the *Joint Explanatory Statement on the Consolidated Appropriations Act, 2014*.

This situation requires strategic planning to help NIJ make the best investments to leverage its limited funds to fill the most critical needs of law enforcement practitioners that are not being addressed (and are not likely to be met in the near future) by law enforcement agencies themselves, commercial providers, or other government organizations. Beyond NIJ, the situation requires strategic planning information for the full range of technology developers supporting law enforcement, so that they better understand of the law enforcement community's needs and priorities. Developing a strategic plan requires good data on the priority needs of law enforcement practitioners, the current and projected future state of the art of relevant technologies, current efforts within the community and by vendors and other agencies, and consistent and proven strategic planning approaches and methods. The RAND Information and Geospatial Technologies Center, which is part of NIJ's National Law Enforcement and Corrections Technology Center (NLECTC) system, has been conducting strategic planning activities to support NIJ in the area of information technology (IT), collecting and analyzing data on law enforcement needs and potential solutions through technology assessment studies, extensive outreach and liaison activities, and subject matter expert panels.

The strategic planning recommendations in this report present both general recommendations covering common themes and prioritized lists of specific needs. In line with the dedicated technology areas of the center, this report focuses on IT-related needs for law enforcement. These needs and themes are intended for technology developers and funders in general, including both NIJ and other organizations. Further, both are intended to be living documents—both are managed in simple databases that are transitioning to RAND's fiscal year 2014 initiative to capture and prioritize technology needs for the criminal justice community, supporting NIJ.

This report does not explicitly make science and technology (S&T) investment portfolio recommendations; doing so would require both specific cost estimates for proposed projects to address technology needs and overall budget lines. However, the report does provide many of the inputs needed to support portfolio planning, by either NIJ or other technology development funders.

The rest of this chapter reviews prior work on identifying technology needs for law enforcement. The subsequent sections introduce a framework for organizing and assessing IT needs for law enforcement. The framework includes two elements. The first is a set of capabilities that defines what IT does for law enforcement. The second is an analysis of law enforcement agencies' missions, functions, and objectives, which describes the ends the IT capabilities serve. The last half of this chapter then summarizes the research activities conducted by the center that supported strategic planning for NIJ. Chapter Two presents the IT needs for law enforcement, along with analyses of how the needs support specific technology areas and law enforcement objectives. Finally, Chapter Three identifies major crosscutting needs and presents recommendations for the ways ahead.

Prior Work on Identifying Technology Needs for Law Enforcement

In developing and identifying technology needs—whether directly or through technology assistance studies—the center identified a number of prior studies on law enforcement technology needs that were directly relevant. These studies are listed below. Although the center

did not copy needs from these prior studies into its technology database, these are important references that informed the center's research.

General assessments of law enforcement technology needs. The first group of studies provides general assessments of law enforcement agencies' technology needs. *Challenges and Choices for Crime-Fighting Technology: Federal Support of State and Local Law Enforcement* (Schwabe, Davis, and Jackson, 2001) reports on a survey of departments about technologies desired but not accessible at the time, systems that needed replacement, and barriers to the adoption of new technologies. *Law Enforcement Priorities for Public Safety: Identifying Critical Technology Needs* (International Association of Chiefs of Police [IACP], 2005) reports on a survey of departments that asked which technologies and technology categories were of greatest priority to law enforcement. *Law Enforcement Technology Needs Assessment: Future Technologies to Address the Operational Needs of Law Enforcement* (Koper, Taylor, and Kubu, 2009) reports on an agency survey and workshop to assess agencies' operational needs, technology priorities, and barriers to adopting new technologies. Finally, *High-Priority Criminal Justice Technology Needs* (NIJ, 2010) presents a list of needs for criminal justice technology RDT&E.

Assessments of IT-related needs. The second group of studies provides needs for specific types of technologies and systems. *Standard Functional Specifications for Law Enforcement Records Management Systems Version 2* (Law Enforcement Information Technology Standards Council, 2010) and *RMS Technical Requirements for Crime Analysis* (International Association of Crime Analysts [IACA] Standards, Methods and Technology Committee, 2013) both specify needs for law enforcement records management systems (RMSs). Similarly, *Priority Data Exchanges for Local Communications Centers: A List of Data Exchanges Relating to Computer Aided Dispatch Systems* (Parker and Wisely, 2009) and *High Priority Information Sharing Needs for Emergency Communications and First Responders* (Unified CAD Project Committee, 2012) present information-sharing needs for emergency response, primarily related to law enforcement's computer-aided dispatch (CAD) systems. More broadly, *Why Can't We Share?* (National Criminal Justice Association et al., 2010) presents high-level needs for information-sharing across the criminal justice enterprise. Finally, *Recommendations of the Emergency Communications Task Force* (Wisely, Wormeli, and Gabbin, 2013) presents high-level needs and ways ahead to address information-sharing needs for first responders, including law enforcement.²

A Framework for Organizing and Assessing IT Needs for Law Enforcement

Our framework includes two core elements: a taxonomy for categorizing what the need is and a set of objectives for categorizing what the need would do to further law enforcement. The use of these two elements allows us to characterize how well needs and solutions (both proposed and current systems) collectively cover different types of technologies and collectively support different law enforcement purposes.

² As part of the center's technical assistance efforts, center researchers contributed to this report, principally by comparing the priorities of information exchange needs with what had been done to support those exchanges to date and identifying gaps between the two.

Categorizing Technologies and Technology Needs

To support characterizing both needs and technical capabilities, we have developed a taxonomy of criminal justice technologies covering law enforcement, courts, and corrections, along with overlaps between them. Figure 1.1 shows an excerpt of this taxonomy, focusing on IT and IT-related technology categories that support law enforcement. The excerpt includes both materiel IT technologies (hardware and software) and nonmateriel elements needed to use IT effectively (policies, practices, training, educational materials, etc.). We use this taxonomy to characterize the priority IT needs for law enforcement in this report. Most needs in this report fall under the “Information” taxonomy divisions (highlighted in gold), but a few needs identified during our research fall under other areas. An example of the latter are needs to reduce the size and weight of electronics carried by officers; these fall under the “Personnel Clothing, Protection, or Augmentation” category.³ The taxonomy is intended to be a living model, extended and modified over time depending on technological changes and feedback from practitioners and academic experts.

Objectives for Law Enforcement

A consideration of how well IT is supporting law enforcement agencies must begin by reviewing what law enforcement agencies do. Since there is no standard mission statement for law enforcement agencies for policing programs or organizations, the center created one as an example. To do so, center researchers examined results from an Internet search on the term, “mission statement police department,” which led to reviewing ten police departments’ mission statements.⁴ The mission statements had a great deal in common. We summarized them collectively as follows:

To improve quality of life by protecting life and property; reducing, detecting, and solving crime; reducing fear of crime; and enhancing safety in cooperation with the community.

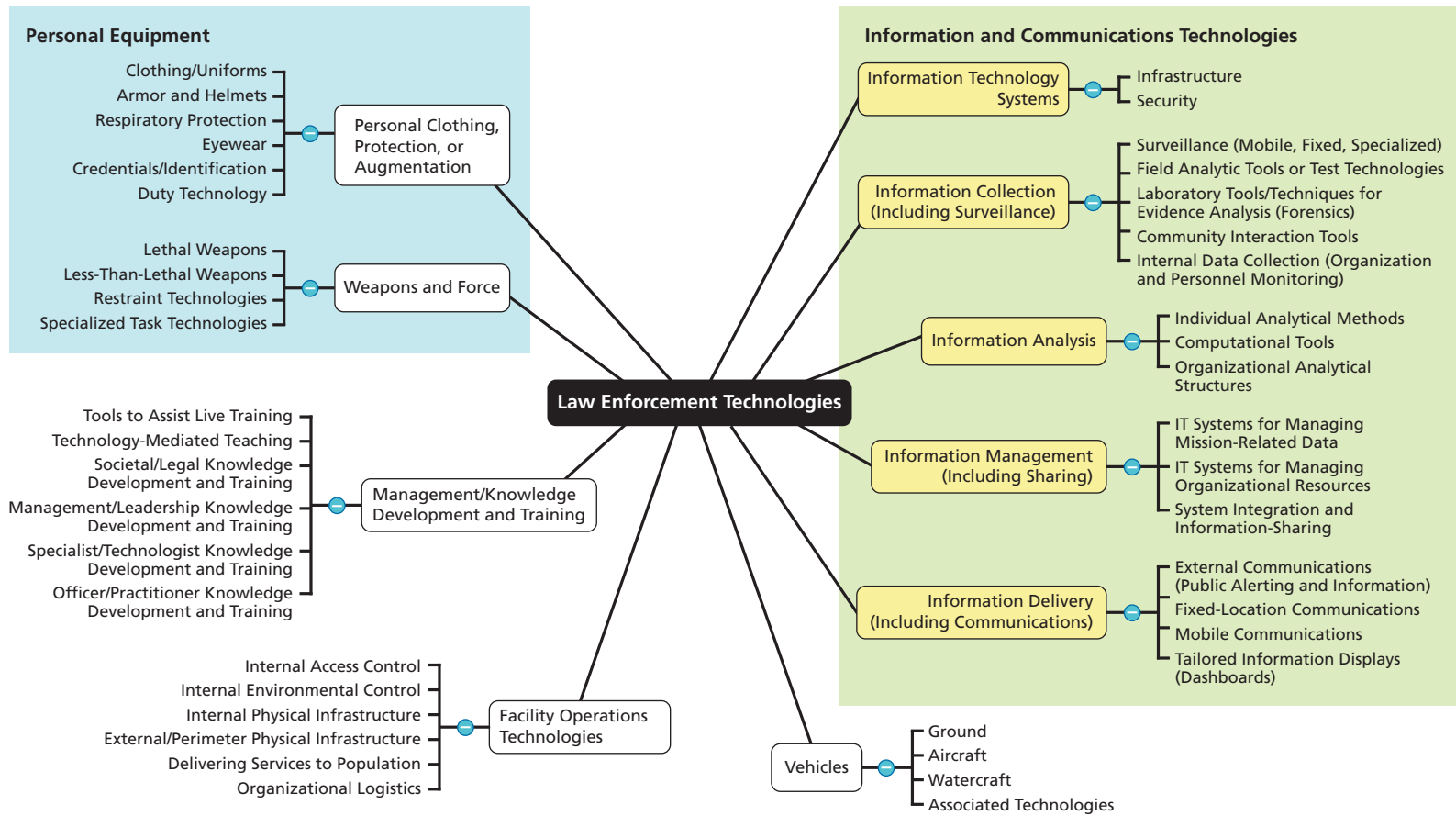
The next step is to decompose the mission into a set of objectives for law enforcement activities. The center developed a set of objectives in two steps. The first was a review of prior research on law enforcement objectives, captured and summarized by Davis (2012) and focusing on Moore and Braga’s (2003) measurement system for police performance. The center then worked with its Law Enforcement Advisory Panel (LEAP) (see the next chapter for more detail on this expert advisory panel) to develop a set of eight objectives, along with subsidiary performance metrics. These are shown in Table 1.1.

In assessing the importance of needs, we asked expert practitioners how much meeting each need would contribute, in real-world terms, to law enforcement agencies’ advancing one or more of these objectives. As discussed below, “how much” is grounded in terms of comparisons to previous breakthrough technologies for law enforcement, such as hot-spot policing or body armor.

³ The taxonomy shown in Figure 1.1 is part of RAND’s project for NIJ to identify the highest-priority technology needs for the entire criminal justice system (including courts and corrections in addition to law enforcement). It builds on earlier center research that identified a dozen IT and geospatial capabilities and several dozen subcapabilities, specifically to characterize technologies that fell under the center’s portfolio. We use the more general taxonomy here to better align the needs in this report with future efforts to characterize criminal justice technology needs.

⁴ This was part of a center study (Jackson et al., 2014) that explored building a model for assessing the effect of IT investments on law enforcement outcomes. See the next chapter for more information.

Figure 1.1
Excerpt from the Criminal Justice Technology Taxonomy: Categories Relating to Law Enforcement Information Technology



RAND RR737-1.1

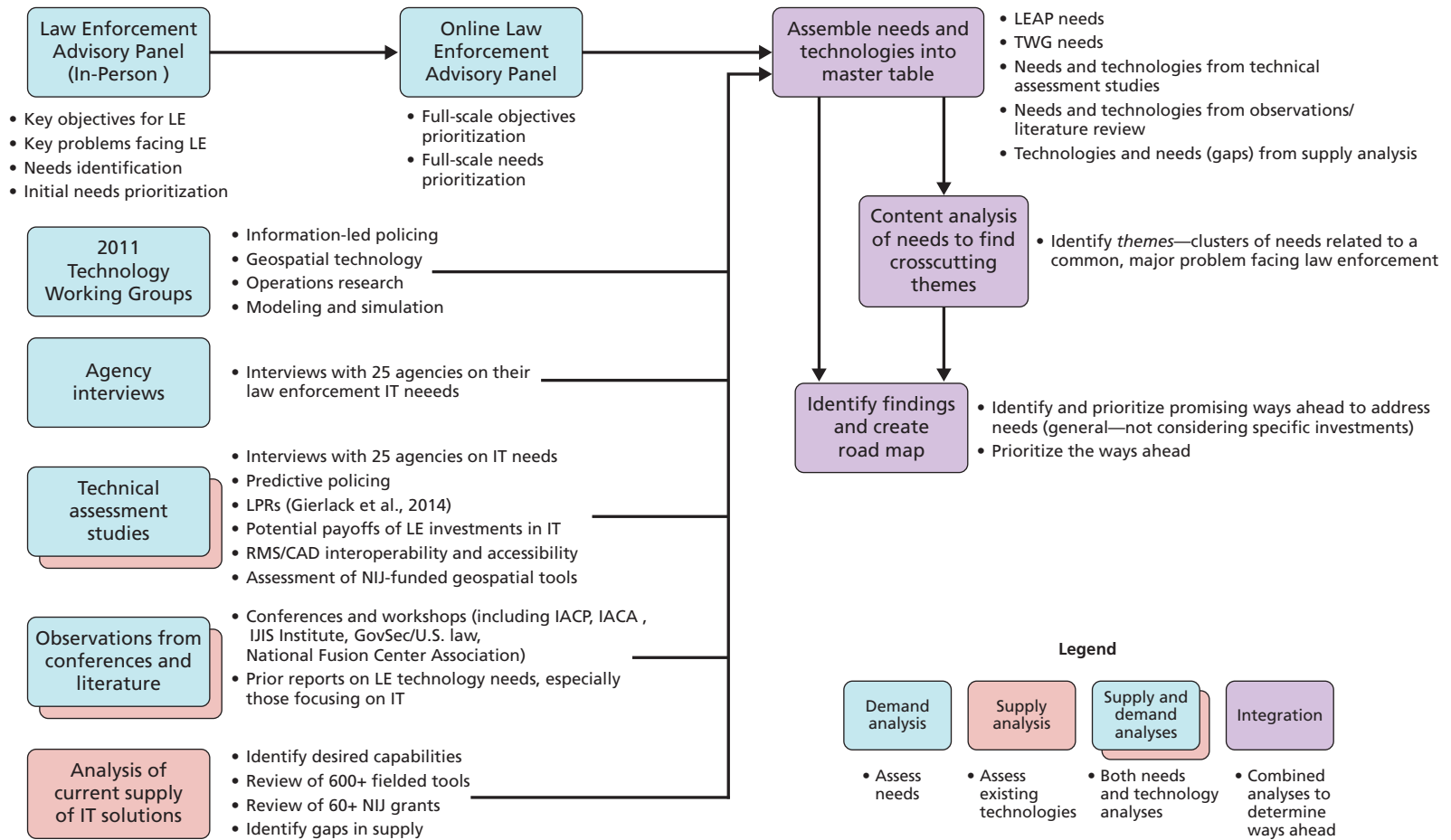
Table 1.1
Objectives for Law Enforcement Activities

Objective Name	Objective Definition	Subsidiary Metrics
Reduce Crime and Disorder	Decrease the numbers of violent crimes, nonviolent crime, and civil disturbances	Counts of various types of crime Counts of various types of calls for service Reductions in recidivism
Solve More Cases	Reduce the numbers of open criminal investigations (i.e., increase the fractions of cases cleared by arrest)	Counts of criminal cases of different types considered closed over time
Improve the Health of Law Enforcement Personnel	Improve the physical and mental health of law enforcement personnel	Counts of sick days Long-term leave days Health-related departures from agencies over time
Reduce Casualties in the Line of Duty	Reduce the numbers of serious or fatal injuries to law enforcement, bystanders, and suspects from all causes (including accidents and use-of-force situations)	Counts of casualties for officers Counts of casualties for bystanders Counts of casualties for suspects
Improve the Public's Trust of Law Enforcement	Increase the public's trust of law enforcement, as well as reduce the public's fear of crime	Surveys asking about agency legitimacy, accountability, and residents' fears of crime
Reduce Costs	Reduce the costs (both in money and time) of law enforcement operations while maintaining effectiveness	Expenses over time Labor hours of over time Changes in above metrics (to check for decreases in performance)
Improve Law Enforcement Competencies	Improve the training, education, and readiness of law enforcement personnel	Numbers of events Numbers of certification Test results showing achieved proficiencies
Respond to Incidents and Events More Effectively	Increase agencies' abilities to prepare for, respond to, and recover from, incidents and events ranging from day-to-day emergency and support calls to large-scale disasters	Timeliness to respond to events Quality of responses as assessed during simulated events

Overview of Strategic Planning Activities for NIJ

Figure 1.2 presents the studies and activities involved in the center's strategic planning support to NIJ. These are described in more detail in the following chapter. The general approach is to analyze technology "demand"—needs for IT—against currently available technologies, the "supply." Demand analyses consisted of multiple expert panels, notably the 2013 LEAP and four technology working groups (TWGs) conducted in 2011. Supply analyses consisted of reviews of over 650 law enforcement technology products and over 60 NIJ grants intended to develop technologies and systems for law enforcement. The center also conducted eight technology assessment studies and attended numerous conferences and workshops, which informed both needs and technology analyses. The final phase consisted of integration analyses to combine "supply" and "demand" into a single set, identify themes that cut across multiple needs, and identify the most promising ways ahead to further IT capabilities for law enforcement. We also see agencies and developers using the data and findings to inform specific decisions about law enforcement IT. Longer term, within the general framework of the road map,

Figure 1.2
Center Activities Supporting Strategic Planning



RAND RR737-1.2

it is possible to conduct formal portfolio optimization for those developers and funders considering alternative investments to create law enforcement IT capabilities.

Although Figure 1.1 shows a single sequence, the actual process was iterative—the tables of needs and themes, and resulting analyses, can be and were updated at regular intervals using results from new panels and studies.

In general, the center's strategic planning methods are developed from RAND's prior work on needs identification and analysis, both in general and specifically related to IT investments. One example is RAND's Portfolio Management methodology for technical portfolio analysis and management. Earlier versions of Portfolio Management have been applied to intelligence community planning (*A Delicate Balance*, Landree et al., 2009) and armed services S&T investment planning (*Toward Affordable Systems I, II, and III*, Chow, Silbergliitt, and Hiromoto, 2009; Chow et al., 2011; and Chow et al., 2012, respectively). Other examples include end-to-end, comprehensive assessments of IT acquisition policies and procedures (Gonzales et al., 2007); electronic extensions of Delphi expert panel procedures, specifically to rate S&T needs (Wong, 2003); and measures and metrics reflecting the operational value of information (Perry, Signori, and Boon, 2004).

Specific studies are discussed below. The needs resulting from all of these studies are consolidated and discussed in the following chapter. Finally, Chapter Three discusses crosscutting themes from across the needs, presenting overarching priorities for future law enforcement technology development.

Assessing Demand for New Technologies: Interviews with Law Enforcement Agencies

The center's first study (Gordon et al., 2012) conducted interviews with representatives of 25 law enforcement agencies about their IT needs. Agencies were asked about

- times during both routine operations and major incidents in which they wished they had some sort of information or IT tool
- their current IT and analytics capabilities, and of those capabilities, which worked well and which needed improvement
- lessons learned on IT systems acquisition
- how they currently learned about IT and their familiarity with NLECTC and NIJ technology outreach efforts (notably NLECTC's website, *JUSTNET.org*).

Following the interviews, the center conducted a content analysis on the interview notes, identifying needs and themes that occurred frequently across the interviewees. Specific needs emerging from this study are documented in the next chapter. All needs identified were named in some form by at least 40 percent of agencies interviewed (in response to general questions about their technology needs). The 40 percent threshold was a natural breakpoint, as other needs were not named by more than a handful of departments.

Two needs were named independently by over three-quarters of departments. The first was a desire for low life-cycle costs for technologies in general. The second was that professional associations provided the key channels through which agencies learned about new technologies and that federal efforts should leverage the associations.

In general, common themes included a need for improved access to basic IT systems, both records management infrastructure and sensors (such as cameras and license plate readers), reduced total life-cycle cost of IT, and a lack of familiarity with JUSTNET and other federal outreach efforts (instead, agencies reported about learning through technology primarily through associations and vendor contacts).

Assessing Demand for New Technologies: Technology Working Groups

The center ran two sets of expert panels to identify and prioritize technology needs. The first, in 2011, consisted of meetings with the then-existing TWGs on four technology areas—geospatial technologies (interpreted to include crime analysis and analytics in general), information-led policing (interpreted to mean IT for law enforcement in general), modeling and simulation (which historically focused more on training systems), and operations research (interpreted to mean a broad range of tools and technologies for improving decisionmaking).

With these groups, the center first asked TWG members to brainstorm their ideas for research and development needs under their portfolios. The center employed a Delphi analysis approach to prioritize needs.⁵ With Delphi methods, panelists have the opportunity to compare how they rated needs with how the rest of the group rated the same needs and then have the option of either changing their ratings or writing comments explaining their ratings. The goal of Delphi methods is to help build group consensus for ratings. The specific method employed was E-DEL+I (Wong, 2003), in which TWG members filled out and reviewed several rounds of Microsoft Excel spreadsheets. TWG members were specifically asked to assess needs along a number of criteria, with four considered “core”:

- *Value*: operational value of the resulting capability, assuming that the research effort is successful
- *Risk*: technological risk of the research effort
- *Cost*: implementation cost to the user, including acquisition, consulting, and training, operating, and maintenance costs; this was used as an indicator of how widespread the successful solution for this need will be implemented by law enforcement agencies of all sizes; a lower cost would have a wider acceptance
- *Funding*: funding required from NIJ to conduct the research effort.

Each criterion was rated using four-point Likert scales; the first three scores were multiplied together and then divided by the funding score to give overall value scores. A summary of all TWG needs and ratings was presented to NIJ in September 2011.

⁵ Delphi methods were developed by RAND in the 1960s to foster consensus among panels of experts. Key references include Dalkey and Helmer (1963) and Brown (1968).

Assessing Demand for New Technologies: The Law Enforcement Advisory Panel

The second type of expert panel carried out by the center (in 2013–2014) consisted of the in-person and online LEAP. The methodology used in the LEAP is intended to build on lessons learned from the 2011 TWGs, plus contemporary research on running advisory panels and prioritizing needs in ways that are both analytically sound and practical to explain and employ. The approach provides far more depth than typical “what are your requirements?” interviewing used in conventional requirements-gathering. Instead, in considering a proposed need, the method addresses

- what operational objectives the need would support if met
- how important the need is with respect to solving real-world problems that occur during day-to-day or crisis operations
- whether it is technically feasible to meet the need
- whether it is operationally feasible to meet the need
- the overall expected value to the practitioner community of meeting each need.

The LEAP was a pilot effort; the methodology will be further refined and expanded in upcoming panels under the “Identifying the Highest Priority Criminal Justice Technology Needs” project for NIJ (referred to in this document as the Priority Criminal Justice Needs Initiative). The advisory panels can be targeted to specific topics (operational issues or technologies) and time frames (current or anticipated future needs). RAND can also run subsequent online panels in which up to thousands of participants collectively assess needs and suggest new ones.

The overall methodology’s six steps are presented in Figure 1.3. The methodology was piloted during the Center of Excellence’s (COE’s) activities, intended to address the following somewhat conflicting objectives. They should be

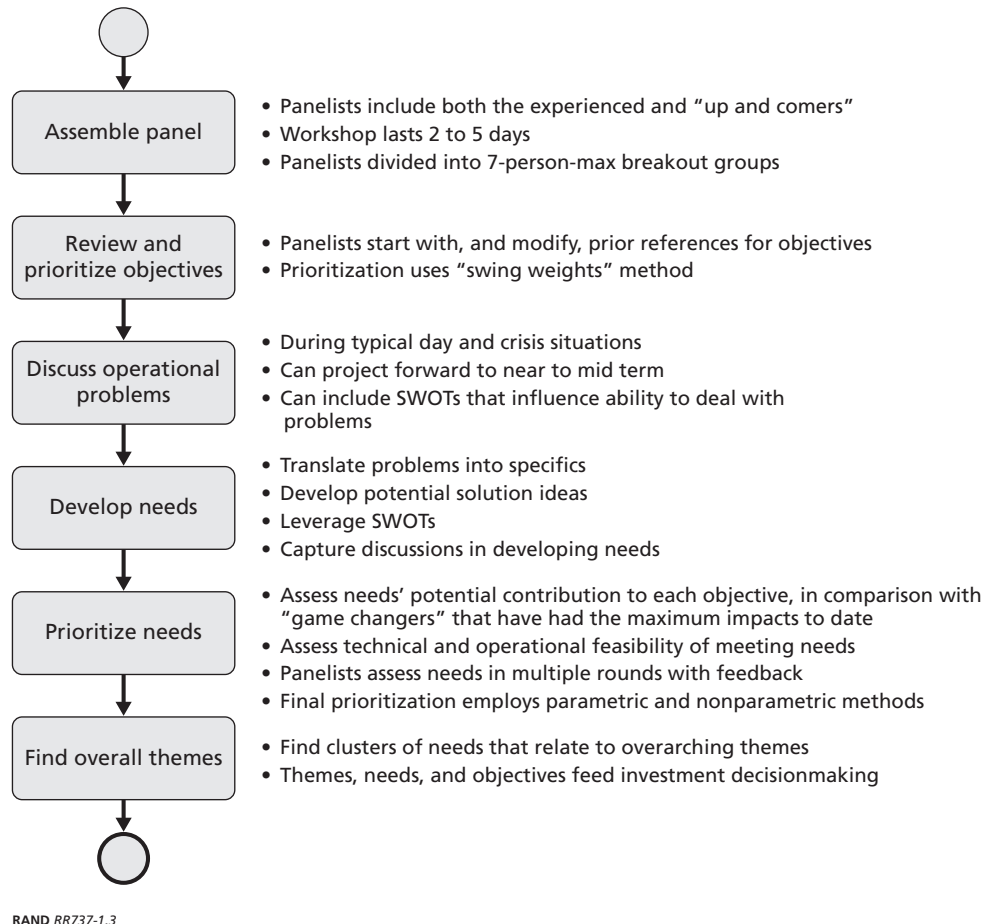
- rigorous, providing logical justifications for needs and their priorities
- comprehensive, covering a wide range of needs across various capabilities and objectives
- comparatively easy to understand, so that interested stakeholders without mathematical degrees can understand the process and thus where the needs and priorities came from⁶
- comparatively easy to execute during a multiday workshop.

The implementation of the methodology during the LEAP is described below.

The LEAP had two phases. The first phase was an in-person panel, held June 25–28, 2013. The second phase was an online web assessment built with RAND’s survey web platform, the Multimode Interviewing Capability, held in 2014. The first phase provided an initial run-through of all the steps in the methodology shown in Figure 1.3. The second phase, intended to test an online version of the methodology, generated revised prioritizations for objectives and needs.

⁶ Drake (1972), for example, as part of a book on the applications of operations research to improving public services, advises that formal modeling taught to public administrators “have no mathematics prerequisite beyond high school algebra” and contains “almost no mathematical analytical details or procedures.”

Figure 1.3
LEAP Methodology



Assembling the panel. The in-person LEAP took place on June 25–28, 2013. The panel included expert practitioners from a variety of roles and agency types. After an initial opening session, the panelists were split into three breakout groups, as follows:

- *Group 1, tactical policing.* This group covered functions in the field, including general patrol, stops and interviews, response to calls, directed patrols, community policing, problem-oriented policing, and other activities. It also included special functions, such as Special Weapons and Tactics, search for perpetrators of major crimes, event response, and disaster response.
- *Group 2, crime analysis and investigation.* This group covered functions, including COMPSTAT, situational awareness maps and displays (crime maps and other geospatial information), predictive policing, link analysis, field investigative activities, forensics, and intelligence activities.
- *Group 3, operational policing.* This group covered command-of-policing activities under both routine and high-stress conditions; strategic decisions, including budget decisions; and department-wide support functions, including human resources, health, training, equipment, dispatch, records management, and communications.

The same group of panelists participated in the online LEAP.

Reviewing and prioritizing law enforcement objectives. For the initial in-person LEAP, the COE experimented with having a two-tiered set of objectives—a top-level set of missions for law enforcement, each supported by a subsidiary set of performance dimensions that measure how well that mission is being met. In the opening session, the full panel discussed the most important missions for law enforcement, along with several dozen performance dimensions for assessing how well those missions are being met. The missions and performance dimensions were seeded on the basis of prior research in this area, captured and summarized by Davis (2012), focusing on Moore and Braga’s (2003) measurement system for police performance.⁷ Figure 1.4 shows the complete set of objectives and performance dimensions identified by the panelists at the end of the session, with the one mission and ten additional performance dimensions, added by the panel, highlighted in yellow.

The panelists also prioritized the missions using the “swing weights” approach (Von Winterfeldt and Edwards, 1986). Using swing weights, panelists rated the value of accomplishing a mission as a percentage of the next-highest-prioritized mission. For example, a panelist might weight the third-ranked mission as 42 percent as important as the second-ranked objective. Each panelist’s swing weights were averaged across all panelists to produce an overall set of swing weights. By convention, the swing weights are normalized to be between 0 and 1, with the sum of the swing weights equaling 1. Figure 1.5 shows the swing weights from the in-person LEAP. As shown, Prevent Crime and Disorder had the highest weight, with twice

Figure 1.4
Mission and Performance Dimensions for Law Enforcement

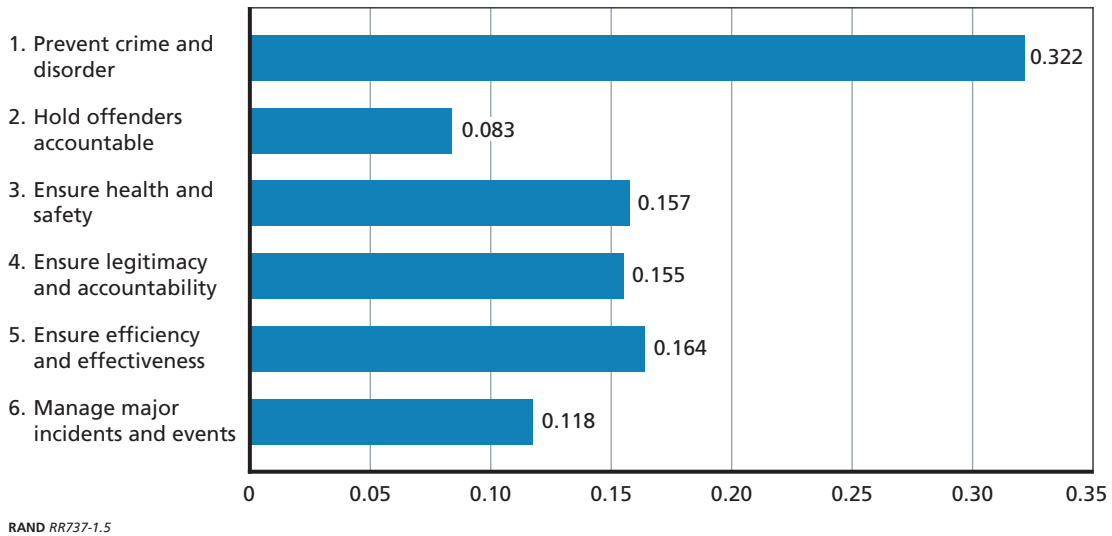
Missions	1. Prevent crime and disorder	2. Hold offenders accountable	3. Ensure health and safety	4. Ensure legitimacy and accountability	5. Ensure efficiency and effectiveness	6. <i>Manage major incidents and events</i>
	11. Reductions in crimes	21. Increases in clearance rates	31. Increases in officer health	41. Increases in legitimacy indices	51. Savings in resource expenditures	6.1 <i>Improve preparedness indices</i>
	12. Reductions in disorder	22. Increases in conviction rates	32. Reductions in officer casualties	42. Reductions in problem encounters	52. <i>Reduce service times and backlogs</i>	6.2 <i>Improve response indices</i>
	13. Reductions in fear of crime	23. <i>Reductions in recidivism</i>	33. Reductions in bystander casualties	43. <i>Reductions in use of force</i>	53. <i>Reduce demands for service</i>	6.3 <i>Improve recovery indices</i>
	14. <i>Improved emergency outcomes</i>			44. <i>Increases in internal performance measures</i>	54. <i>Improve competencies</i>	

NOTE: Yellow boxes and italicized text were added during the LEAP (ten dimensions, one mission).

RAND RR737-1.4

⁷ As described below, this more complex set of missions and performance objectives was later simplified in collaboration with the panel to the streamlined set of eight objectives included in Table 1.1.

Figure 1.5
Weights on the Missions from the In-Person LEAP



the value of the second-closest competitor. Hold Offenders Accountable and Manage Major Incidents had the lowest, and the other three fell in between and were very close together.

Since the swing weights approach requires on the order of n^2 comparisons to weight n needs, we did not have panelists weight the 21 performance dimensions. Instead (as will be discussed below), the subsidiary performance dimensions were assumed to have the same “weight” as their parent mission.

Members of the panel and observers felt that six missions and 21 performance dimensions, while providing detailed information, were difficult to work with. Following the panel, a pattern analysis examining how needs supported missions and performance dimensions found that needs tended to support clusters of related performance dimensions simultaneously. Using these results, the Center, with the review and approval of the LEAP members, consolidated the missions and performance dimensions into a single set of eight objectives for law enforcement, along with subsidiary metrics. These final objectives and their subsidiary metrics (repurposing what were originally performance dimensions) are presented in Table 1.1. The substantive differences between the original missions and the final objectives include the following:

- The mission “ensure health and safety” was split into the objectives “improve health” and “reduce casualties in the line of duty.”
- The mission “ensure efficiency and effectiveness” was split into the objectives “improve law enforcement competencies” (i.e., support improved effectiveness in general) and “reduce costs.”

Other changes were largely administrative, responding to panelists’ suggestions for clearer language to describe the objectives.

The online LEAP included a modified swing weights exercise to prioritize the newly defined eight objectives, in which panelists first identified their top objective and then rated the other objectives’ importance as a percentage of the top-ranked objective. This change addressed both practical constraints on the Multimode Interviewing Capability platform and concerns

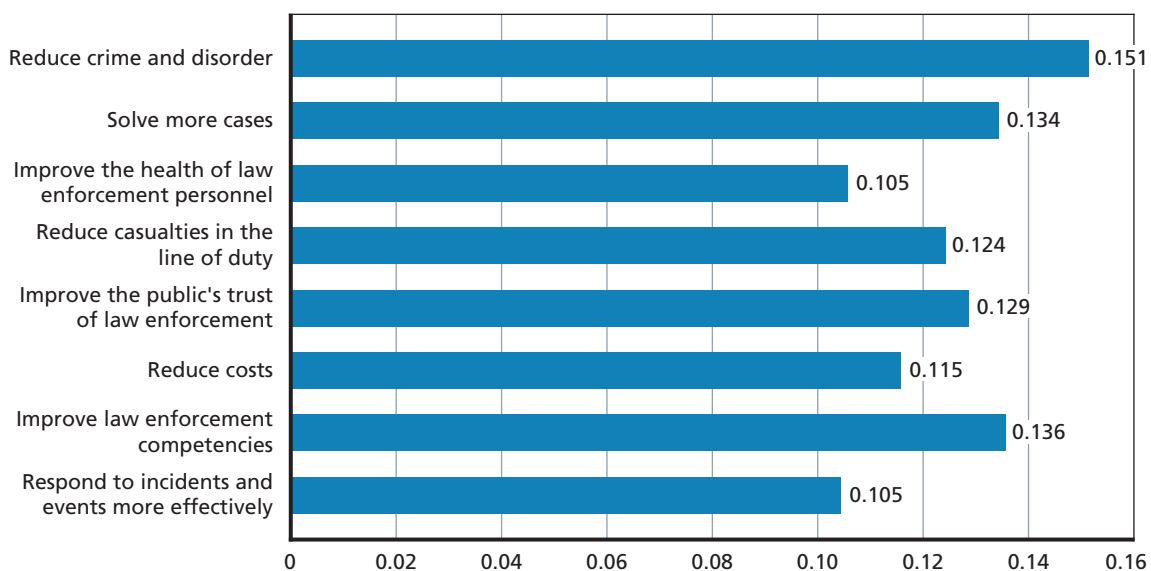
that the original swing weights exercise was confusing and could result in weights that were different from what panelists intended. Specifically, with original swing weights, lower-ranked weights are derived from ever-lengthier products of percentages (from all the higher-ranked missions). Thus, a panelist could have an overall impression that the missions were fairly close in importance and, for example, rate each successive mission as 75 percent of the previous mission. They would end up with weights on lower-ranked missions that were much lower than intended, as $(0.75)^5$ is just 0.24.

Figure 1.6 shows the weights for the eight law enforcement objectives from the online LEAP. These weights are much more closely distributed. Reduce Crime and Disorder continued to be the most important, but now the difference between it and the second-ranked objective (Improved Competencies) was only about 10 percent. Similarly, the difference between the top- and bottom-ranked objective (Improve Health) was 30 percent, as opposed to almost 75 percent for the weights on the original missions.

Discussing operational problems and developing needs. Needs were generated as part of the in-person LEAP. Within the breakout sessions, the panelists were asked to think about going through the routine activities on their typical day and identify what problems cause them and their associates the most difficulty. Panelists were then asked to think about a “high-stress” day for the organization—a major crime response, a disaster response, or providing security for a major event, for example—and asked the same question, to identify the most pressing problems. This framing focused panelists’ attention on the most pressing problems facing law enforcement today.

To provide additional information to help inform writing needs, panelists were also asked to conduct a SWOTS analysis for each major problem—what resources they currently could bring to bear on the problem (strengths), what deficiencies they had (weaknesses), what external developments might be leveraged (opportunities), and what external developments might make the problem worse (threats).

Figure 1.6
Weights on Law Enforcement Objectives



The moderators then walked back through the problems to help the panelists identify needs. *Needs* are requirements to help fix a pressing problem (or projected future problem) so that law enforcement agencies can better meet an objective. To create needs, panelists were asked to translate problems into specific terms with measurable elements. An example would be to convert “we don’t know who a stopped person is” into “have positive ID of a stopped person within one minute of starting a query.” Panelists were also asked for a solution concept—a few words on what a solution might look like (“mobile device with multiple sensors that can query state and national ID databases”). These were transcribed into needs descriptions.⁸

Following the in-person panel, RAND analysts compared the needs generated by the three breakout groups and consolidated near-duplicate needs, with the approval of the LEAP panelists. This reduced the total number of needs from 81 to 67.

Prioritizing needs—providing ratings. In both the in-person and online LEAPs, the panelists provided ratings for the needs. *In the in-person LEAP only*, the panelists were asked to identify which of the 21 original performance dimensions (and hence, missions) each need supported. Panelists rated the needs from only their own breakout group. *In the online LEAP only*, the panelists rated the contribution of each need to each of the eight objectives shown in Figure 1.1. Panelists rated randomly selected subsets of needs; each panelist was asked to rate at least 20 needs.

For both the in-person LEAP and online LEAP, panelists were asked three questions to rate the needs, each on a scale from 1 to 9:⁹

- *How much impact could satisfying this need have on achieving this performance dimension (for the in-person LEAP) or objective (for the online LEAP)?* Here, panelists were asked to consider “impact” in comparison with previously fielded technologies. A need scoring the maximum (9) was assessed to have the same potential impact as the biggest “game changers” in the field—for example, in law enforcement, “game changers” presented included body armor (can reduce line-of-duty fatalities by 30 percent) and hot-spot policing (can reduce crime rates by 15–20 percent).¹⁰
- *What is the likelihood that a solution to this need could succeed, technically?* Maximum scores (9) implied very low technical risk, typically involving only slight adaptation of existing systems. Minimum scores (1) implied very high technical risk, typically needing entirely new technologies that might not be available or even physically possible.

⁸ Although we did not insist on strict adherence to it, the advice to panelists on how write needs was based on *operational definitions*, which are specifications for a system or process that identify a criterion to be met, a test for measuring whether the criterion has been met, and a decision rule to determine whether the system or process meets the criterion as the result of the test (Deming, 1982, pp. 287–289; Department of the Navy, 1996).

⁹ Specifically, we asked the panelists to do each rating in two parts. In part 1, they were asked whether they thought the impact could be as high as “game changers,” low, or in between (medium). In part 2, they were asked whether the impact was in the high, low, or middle of the general rating category (e.g., high, low, or medium side of the “high” rating bin). This scheme let panelists think about only three potential ratings at any one time, starting with a broad characterization of where the need falls and then move to a fine-grained assessment. It is based on the procedure of *bracketing*, used to elicit a person’s preferences in decision analysis by iteratively narrowing in on an answer (see, for example, de Neufville, 1990, p. 378).

¹⁰ The reference to “game changers” is intended to ground both ends of the ratings scale in real-world terms, with 9 being the best technological developments that have actually occurred to date and 0 corresponding to no improvement. That hot-spot policing can result in crime decreases of 15–20 percent or more is from a meta-analysis by Braga, Papachristos, and Hureau (2012). Bir et al. (2011) estimate that police fatalities could be reduced by 30 percent if all officers wore body armor.

- *What is the likelihood that a solution to this need could succeed, operationally and politically?* Maximum scores implied that solutions are both easy to adapt and have low political and policy risk; minimum scores implied that solutions either could not be implemented or could not be accepted by policymakers and the public.

Prioritizing needs—Delphi rounds. As with the TWGs, RAND employed a Delphi method during the needs ratings for both the in-person and online LEAP panels. In the in-person LEAP, after the first round of ratings, panelists were told which needs ratings had especially wide variations in ratings; they then discussed among themselves why they rated the need in particular ways. Following the discussion session, panelists could choose to rerate the needs if they wished.

In the online LEAP, panelists were permitted to write comments on ratings about which they felt particularly strongly. Then, after completing the ratings for each question, each panelist got immediate feedback in that they saw their ratings compared with the average ratings to date, along with a popup box that showed the comments for that need to date. The panelists could then rerate the needs if they wished.¹¹

Prioritizing needs—expected value scores from individual respondents. From both the in-person and online LEAPs, the potential impact and risk assessment scores were combined mathematically to estimate the likely operational payoff (*expected value*) of satisfying each need. Here, the expected value is a function both of how beneficial addressing the need would be (in terms of contributing to one or more objectives) and how likely it was that a solution for the need could be developed and deployed in the law enforcement community successfully. High-priority needs will tend to contribute to multiple objectives, make major potential contributions toward those objectives, and be comparatively low risk both technically and operationally. We generated one expected value score per need per respondent. See the footnote below for the specific mathematical formula used.¹²

¹¹ This approach is similar to that used under the auspices of web-based “Real-Time Delphi” surveys (see, for example, Gordon, 2009).

¹² Here, expected value is measured with respect to both the operational benefit and probability of successfully fielding a technological breakthrough similar to ones that have come before, such as hot-spot policing. Mathematically, the total expected value for need i is given by

$$S_i = \sum_j (S_{ij}) = \sum_j (w_j I_{ij} v_{ij} P_{1i} P_{2i}),$$

where

- w_j is the swing weight applying to objective (or, originally, performance dimension) j , I_{ij} is a 0–1 indicator for whether need i supports objective (or performance dimension) j , and the summation reflects the need’s total value across all dimensions.
- v_{ij} is the estimated benefit (measured from 1 to 9) with respect to objective (or performance dimension) j if a project to satisfy need i is successful. Here, 9 = a game changer—15 to 30 percent or more improvement in a performance measure; 0 = small improvement, if any.
- P_{1i} is the estimated probability that a project will succeed *technically*. High scores occur if there are no major technical risks and the necessary knowledge or science is well understood.
- P_{2i} is the estimated probability that a project can be *implemented operationally*. High scores occur if there are no major operational, political, life-cycle cost, or cultural barriers to implementation.

Prioritizing needs—expected value ratings from the panel. To get a panel-wide expected value rating for each need, from either the in-person LEAP or the online LEAP, we simply took the *median* of the respondents' expected value rankings. The median is the score that has the middle rank (50 percent of scores are higher, 50 percent of scores are lower) in the data. Medians were chosen because they are robust—they provide reasonable estimates of the center of the data even given outliers or atypical distributions of the data. They do not require making any assumptions about the underlying statistical distribution of the scores. Since there were fairly few panelists rating any given need, from either the in-person or the online LEAP (average of five raters per need from each), there would be little evidence of any particular distribution that the ratings were following.

Combining scores from the in-person and online LEAPs. There were significant differences between how the in-person and online LEAP needs were assessed—namely, the original missions and performance dimensions were consolidated into eight objectives, and panelists assessed needs' contributions to each of the eight objectives rather than just a few performance dimensions. Thus, the numerical values of the expected value scores were systematically different between the in-person and online LEAPs.

What was the same for both panels, however, was that we had ranks for each based on the panel-wide expected value scores. Thus, we used a simple formula to generate a new rating for each need based on the ranks: A first-place ranking from one of the panels got the highest possible number of points, a second-place ranking got the second-largest possible number of points, and a last-place ranking got the lowest possible number of points. Then, we simply added all the points for each need, and the needs got an overall ranking based on how many total points they have (that with the most points is first).¹³ We then rated each need from 1 to 9, with any need receiving a 9 being in the top ninth of the overall rankings. We used nine ratings bins rather than the raw scores, since there was little practical difference in rankings between needs that were close together, especially given comparatively few raters.

In addition to the nine ratings bins, we further divided needs into *tiers*. A Tier 1 rating is in the top third of the LEAP needs overall and scored reasonably well in both panels (at least a middle rating—a 5—from each panel). A Tier 3 rating is in the bottom third of the LEAP

In words, the equation says that a need's score is the sum of its expected values toward contributing to individual objectives (or performance dimensions, for the in-person LEAP). Each expected value is the operational benefit with respect to previous breakthroughs if an effort to meet the need is successful, times the probabilities that such efforts will be technically and operationally successful.

¹³ Specifically, we employed a modified Borda count to generate a new rating for each need across the in-person and online panel scores. Borda count methods score items using rankings from multiple sources (e.g., rank-order votes from different people, different search engines' scores). Borda count methods have been around for centuries, first being popularized by the French scientist Jean-Charles de Borda in 1770. For a general treatment, see Levin and Nalebuff (1995); for a discussion of how Borda counts and extensions have been used in search engines, see Liu et al. (2007). The specific method was as follows:

- Sorted each need into one of nine bins by their rank. Items in the top ninth received a rating of 9; items in the second ninth received a rating of 8; and so on, with items in the middle ninth receiving a 5 and the bottom ninth receiving a 1.
- Performed this sorting for both in-person and online LEAP scores and added the bin numbers from the two panels together. For example, the highest possible combined rating was 18 (9 + 9) and the lowest was 2.
- Ranked the needs again in order of combined ratings and assigned a new overall bin to each need (9 for needs with a combined rating in the top ninth, and so on).

needs overall and scored reasonably poorly in both panels (at most a 5 from either panel). A Tier 2 rating is any other need in between. These three tiers are intended to quickly group the needs into sets of highest-priority, medium-priority, and lowest-priority needs.

Technology Assessment Studies

The center conducted a number of detailed assessments of technology areas. These typically combined literature reviews, market analyses, interviews, focus group, and site visits to assess a law enforcement technology area, identifying recommendations for policymakers, for those seeking to acquire the technology and for those seeking to use the technology successfully. These studies also generated additional technology needs for law enforcement. Specific needs from these studies are captured in the following chapter; high-level descriptions of the studies and their findings are described below.

Examining the Use of Predictive Analytics in Policing

The center prepared a detailed guide on predictive policing (Perry et al., 2013a; summary in Perry et al., forthcoming 2014), which is the use of analytical techniques (usually statistical models) to identify promising targets for police intervention to help prevent crime, solve past crime, and identify potential offenders and victims. Inputs to the study included a literature review and market analysis of predictive policing techniques and products, case studies, and internal experimentation with predictive methods. The resulting guide provides a taxonomy of predictive policing use cases; identifies a comprehensive process for predictive policing focusing on the preventive measures used to respond to predictions (which have been a bit of an afterthought to date); discusses pitfalls that have emerged to date; and presents advice to those considering developing, acquiring, or using a predictive analytics system.

Technology needs emerging from the study include providing tools that are affordable and easy to use; creating tools that provide additional situational awareness information about recent criminal activity, police activity, and other relevant information in addition to the predictions; and additional research and evaluation (R&E) on what sorts of interventions best capitalize on different types of predictions. Following the publication of the report, the center received feedback from the IACA that there was strong demand for a survey of what agencies were doing with predictive policing tools and techniques and for independent testing and reporting on predictive policing tools, similar to that done by *Consumer Reports*.

Examining Prior NIJ-Funded Geospatial Tools

The center evaluated 14 recent geospatial tools funded by NIJ (Wong, Sorensen, and Hollywood, 2014), using a combination of technical surveys of tool developers, surveys of tool users, and internal quality assurance assessments. Center researchers found that 12 of 14 funded projects produced functional tools, although actual dissemination and use to the law enforcement community varied widely. More broadly, the study's authors identified gaps in disseminating tools, calling for increased oversight by NIJ in ensuring the development of usable tools along with plans to disseminate them, increased dissemination of tools (including establishing and publicizing a tool repository), and efforts to improve the interoperability of NIJ-funded tools with existing systems.

Examining the Use of Automatic License Plate Readers

The center prepared a comprehensive guide on the use of automated LPRs in law enforcement (Gierlack et al., 2014), based on a combination of detailed case study analyses and technical literature reviews. Major findings included a need for more research related to using LPR data for crime analysis purposes (beyond reacting to the discovery of a stolen plate), a need for further development of privacy policies, and a need to address both technology and policy barriers to sharing LPR data across agency lines.

Examining Both the Promise and the Pitfalls of Information-Sharing

The center examined the interoperability and cost accessibility of RMS, CAD systems, and other key law enforcement information-sharing systems (Winkelman and Hollywood, unpublished). Key inputs to this study included

- reviewing the recent history of law enforcement information-sharing systems
- reviewing a range of recent interoperability requirements from federal government-sponsored and association-sponsored efforts, to generate a picture of how information would ideally be shared across systems
- assessing federal- and association-sponsored efforts to improve both systems interoperability and affordability, both to date and planned for the future
- identifying remaining barriers to interoperability and affordability as discussed in conferences, workshops, and interviews with agency representatives.

The study identifies both near-term recommendations for agencies seeking to acquire RMS/CAD and other key information-sharing systems and longer-term policy recommendations to improve the interoperability and affordability of information-sharing systems. In general, the center found that although great progress has been made, interoperability and affordability are both “possibles to do” rather than widespread defaults. The study’s authors recommend a common set of interoperability interfaces that are consistent with a master data model specifying core elements (names, addresses, geospatial coordinates, times/dates, etc.). They also recommend creating common policy and request-for-proposal (RFP) language that specifies interoperability requirements, testing compliance with those requirements, information assurance (cybersecurity) requirements, and privacy and civil rights compliance requirements. To improve affordability, in addition to the common interoperability requirements (which will reduce the cost of connecting systems), the authors discuss pursuing software-as-a-service and cloud computing models, shared regional licensing, and other novel and promising acquisition models that reduce outlays by individual agencies.

Examining Investment in Technology in a Financially Challenged Environment

Law enforcement agencies have faced major financial challenges since the start of the recession in 2009 and subsequent state and local budget cuts, with the president of IACP going as far as to say that agencies’ top three challenges in 2011 were “budget, budget, and budget.” In response, center researchers (Jackson et al., 2014) developed a logic model describing how IT and policing activities might work together to produce key policing outcomes. They then conducted some exploratory analyses of a statistical implementation of the model assessing correlations between different types of technologies and processes for using it and crime and clearance rates, using 2007 Law Enforcement Management and Administration Survey data. Because

the data were not well structured for exploring these relationships at the level of detail necessary, the study used the effort to describe what would be needed to test relationships between IT investments and law enforcement outcomes formally. To properly assess IT investments and associated practices, there is a need to collect much more detailed data on exactly what types of systems are being acquired and how they are being used, what types of crime reduction and crime-solving methods are being used by law enforcement agencies, and when new investments in both new systems and new practices are being made.

Examining the Market and Market Gaps for Technology: Supply and Demand Analysis

The purpose of this study was to identify technology areas that appear to have comparatively few systems and NIJ awards with respect to the number of needs. The center compared the “demand” for new technologies, as measured by needs from the TWG and LEAP panels, and the “supply” of available and potentially new technologies, as measured by commercially available systems and recent NIJ awards found and summarized through web searches. Identification of needs—the demand—has already been discussed. On the supply side, center researchers found, through web searches of police technology websites, assessed, and characterized over 650 commercially available systems in 2011 and assessed and characterized 70 NIJ OST awards from 2006–2010. These results were compared with a set of 36 needs that had been previously published in a 2010 NIJ publication.

It should be noted that the systems and award lists are intended only to be reasonable snapshots of what was available and what had been funded as of 2011 (when the study was performed). Both are static snapshots of what information was readily available on NIJ and police technology websites; neither is intended to be a complete list.

Gaps are suggested in cases in which the percentage of the 36 NIJ needs for a technology substantially exceeds the percentage of available systems or recent awards. The appendix describes the specific IT and analytics capabilities and subcapabilities used in the analysis, along with detailed results showing gaps between needs (demand) and current systems and awards identified. The biggest comparative gaps found were for

- providing a common operational picture of relevant law enforcement data for command and planning staff
- providing predictive policing systems (the gap was for deployed systems only; a good percentage of NIJ awards had to do with predictive policing)
- supporting the development of single-source forensics systems (i.e., systems supporting the analysis of one particular type of investigative data in detail)
- providing systems to monitor the health and safety of law enforcement personnel
- providing tools to help agencies improve their operational processes, in general.

Problem Statements from Law Enforcement Conferences

The center identified technology needs statements about major pressing problems or needs facing law enforcement from association conferences, typically presented and discussed during keynote addresses or association committee meetings. Key examples include

- from IACP conferences, pressing concerns in key sessions related to
 - the impact of postrecession budget cuts
 - growing challenges to sensor/surveillance technologies and methods (notably automated LPR systems) over civil and privacy rights issues
 - growing challenges to mass stop-and-frisk and mass arrest tactics over civil rights issues, and calls for replacement intervention strategies
 - information assurance challenges and growing cybercrime
- from the IACP/LEIM [Law Enforcement Information Management] IT Summit—2013—a variety of pressing challenges related to the acquisition, management, and operations of technology; participants were shown potential problems on the administration and management of technology and operation of technology selected by IACP staff and asked to vote on which one was their agency's top problem.

Integration and Analysis of Technology Needs

As shown in Figure 1.1, the center conducted three steps to integrate and analyze all the needs from all the different studies—consolidating the needs into a master table and assigning overall priority scores, identifying themes cutting across the needs, and preparing a roadmap of promising ways ahead to address the needs.

Consolidating and prioritizing needs. Table 1.2 shows all the studies that generated IT needs for law enforcement. The table also shows whether the studies had subgroups (such as breakout groups) and whether the studies prioritized needs and, if so, how. Of key interest in prioritizing needs is which ones are considered Tier 1, or high-priority, IT needs. The table describes which needs from each study, if any, are considered Tier 1. Also note that for any study that prioritized needs, all needs were assigned a ranking bin from 1 to 9 (1 being lowest, for the bottom ninth; 9 the highest, for the top ninth) just based on their rank order from that study.

The needs from all the efforts listed above were consolidated into a master table (shown in the next chapter). As mentioned, the defining characteristic of the needs is which tier (1–3) they are in and, secondarily, which ranking bin, from 1 to 9 (1 low, 9 high), they are in. However, for the purpose of list formatting, we did identify an overall rank order for the needs as follows:

- The first step was to sort all needs by their ranking bin, so that all bin 9 needs are ranked together, followed by all bin 8 needs, etc.
- To sort needs strictly within ranking bins, we created a normalized score from 0 to 1 by normalizing whatever priority scores were used (expected value, percentage responding with that answer, straight ranking, etc.) and sorted needs by that normalized score. We

Table 1.2
Sources for Information Technology Needs for Law Enforcement

Source (Study)	Subgroups	Prioritization Method
LEAP	In-person panel (2013) Tactical group Crime analysis and investigation group Operational group Online panel (2014)	Expected value of meeting the need, across multiple law enforcement objectives, and an assessment of whether a solution could be technically and operationally feasible; Tier 1 needs are those that both ranked in the top third after combining results from the in-person and online panels and scored at least “medium priority” in both panels.
Interviews with law enforcement agencies (Gordon et al., 2012)	N/A	Percentage of agencies naming the need in some form; only needs named by a large proportion of agencies were discussed in the report. Since only the top-named needs from this study were in the report, all needs are considered Tier 1 and assigned rank bins from 7 to 9.
2011 TWGs	Modeling and simulation Operations research Information-led policing Geospatial technologies	Expected value of meeting the need (in general) and an assessment of whether a solution could be technically and operationally feasible.
Law enforcement technology supply and demand analysis (see the appendix)	N/A	Average percentage-point gap between the numbers of needs and the numbers of systems and prior NIJ awards for each technology capability; top gaps between needs and systems/awards were added to the list of needs and are considered Tier 1.
IACP/LEIM IT Summit—2013	N/A	Percentage of participants stating that a given issue identified by IACP staff was their “greatest challenge”; Tier 1 needs had percentage scores in the top third.
Law enforcement conference themes	IACP Law Enforcement Information Management Conferences (2011–2014)	Top priority needs from keynote addresses from these conferences, if applicable; the few such keynote needs from these conferences are considered Tier 1/ranking bin 9
Predictive policing study (Perry et al., 2013a)	N/A	None. Needs assigned to Tier 2 (and ranking bin 5, “medium”) by default
LPR study (Gierlack et al., 2014)	N/A	None. Needs assigned to Tier 2 (and ranking bin 5, “medium”) by default
Geospatial software tool study (Wong, Sorensen, and Hollywood, 2014)	N/A	None. Needs assigned to Tier 2 (and ranking bin 5, “medium”) by default
IT investment study (Jackson et al., 2014)	N/A	None. Needs assigned to Tier 2 (and ranking bin 5, “medium”) by default
RMS/CAD information-sharing study (Winkelman and Hollywood, unpublished)	N/A	None. Needs assigned to Tier 2 (and ranking bin 5, “medium”) by default

emphasize that this sorting is for list formatting purposes; broadly speaking, all needs within the same ranking bin should be considered to have the same priority.

Given that the needs were almost all sourced from advisory panels or field interviews that involved small numbers of participants (the LEAP, the TWGs, or the agency interviews), it is reasonable to ask about the meaningfulness of the rankings. To address the fact that the stud-

ies had small numbers of participants (at most two dozen), for individual needs we focus on which tier a need is in and, secondarily, in which ranking bin. The findings of this report focus on themes drawn from fairly large groups of needs. We do not consider the specific ranking of a need to have a great deal of meaning. That said, we have some confidence that the higher-ranked needs are likely to have greater priorities—or at least not have real-world priorities toward the bottom third.¹⁴

Identifying crosscutting themes and keynotes. To draw overarching findings from the needs, we scanned the Tier 1 needs in reverse priority order and attempted to assign a categorical theme to each need. If there was not already a theme that fit the need well, we created a new theme. The process started with creating a theme for the first need on the list. The process was iterative; after all themes were created and each need had an initial assignment, we rescanned the list of Tier 1 needs several times, checking to see whether another theme was a better fit than one initially assigned, whether it was possible to combine themes in a reasonable way, or whether the description of the theme could be modified to better fit the needs. This approach to infer themes from the needs, and iteratively adjust the needs and themes, is analogous to a standard approach in content analysis to develop and apply codes summarizing attributes of free text (see, for example, Zhang and Wildemuth, 2009). We identified a final set of 11 themes, with each theme having at least three Tier 1 needs and every Tier 1 need assigned to a theme.

The next step in the analysis was to infer sweeping issues that united groups of themes. We recognized three keynotes that cut across the 11 themes and the Tier 1 needs: one on the need to improve the law enforcement community's knowledge of technology, one on improving law enforcement information-sharing and use in general, and one on developing "other" technologies for law enforcement.

¹⁴ To assess the statistical significance of the general rating of a specific need (tier or bin number), we adapted nonparametric statistical tests that use ranking information only; they do not take into account any assumptions about how the ranks were generated. The null hypotheses for the tests are that the bin numbers are just random assignments, with the probability that any particular assignment of bins of needs is uniformly distributed. We calculated the explicit probability distributions for the difference in bin numbers between two needs randomly assigned to the ranking bins, assuming that the null hypothesis is true (i.e., each need is randomly assigned to bins 1 through 9). We then calculated the probabilities that a lower-ranked need actually has a higher real-world ranking than the higher-ranked need. Thus,

- The probability that a need assigned to bin 1 has a greater real-world priority than a need assigned to bin 9—or a difference of eight bins—is 1.2 percent.
- The probability that a need ranked seven bins lower than another need has a greater real-world priority is 3.7 percent.
- The above probabilities are small enough that a seven- or eight-bin difference between needs can be considered statistically significant at the 0.05 percent level.
- For a difference of six bins, the probability is 7.4 percent. This is the median probability that a given Tier 3 need should be ranked higher than a given Tier 1 need. This difference is statistically significant at the 0.10 percent level.
- For a difference of five bins, the probability is 12.3 percent.
- For a difference of four bins, the probability is 18.5 percent.
- Finally, for a difference of three bins, the probability is 25.9 percent. This is the probability that the highest-ranked Tier 3 need should be ranked above the lowest-ranked Tier 1 need.

We have stronger results for the rankings of needs that came from the LEAP, since each need being assigned to a ranking bin in two separate sessions (in-person and online) provides more ranking data with which to work. Thus, the median probability that a given Tier 3 LEAP need should be ranked higher than a Tier 1 need was 3.2 percent (significant at the 0.05 percent level); the probability that the highest-ranked Tier 3 LEAP need should be ranked higher than the lowest-ranked Tier 1 need was 10.8 percent.

Defining ways ahead and creating the road map. In the final analysis, the center identified potential ways ahead to address the keynotes and themes. The ways ahead are all straightforward interpretations on what tasks will be needed to make progress on addressing high-priority IT needs for law enforcement. The road map is presented at the end of Chapter Three and has three parts. The first three parts each address one keynote and its constituent themes and needs. The fourth part addresses what will be needed to keep lists of high-priority needs for law enforcement maintained and updated over time.

Information Technology Needs for Law Enforcement

Law Enforcement Information Technology Needs

Table 2.1 presents the complete list of all information technology needs for law enforcement, generated and prioritized from the studies described in the previous chapter. Needs are presented by technology area (specifically, top technology taxonomy division as shown in Figure 1.1), in alphabetical order:

- Facility Operations Technologies
- Information Analysis
- Information Collection (Including Surveillance)
- Information Delivery (Including Communications)
- Information Management (Including Information-Sharing)
- Management/Knowledge Development and Training
- Personnel Clothing, Protection, or Augmentation
- Weapons and Force.

Within technology-area tables, needs are sorted first by technology class (again, coming from the technology taxonomy) and then by priority, with higher-ranked needs presented first. That said, we emphasize that there is little practical difference between needs ranked closely together. For each need, we provide

- technology category; we show needs by both top-level division and specific technical category, in the format “[division]: [category]”
- need title
- need description
- source, marked as follows:
 - *agency interviews*: initial interviews with 25 law enforcement agencies (Gordon et al., 2012)
 - *TWGs*: needs from the 2011 TWGs—further noted as from the modeling and simulation, operations research, information-led policing, or geospatial technologies TWG
 - *LEAP*: needs from the LEAP (both in-person and online) sessions—further noted as from the Operational, Crime Analysis and Investigative, or Tactical breakout groups
 - *predictive policing*: predictive policing study (Perry et al., 2013a)
 - *tool evaluation*: evaluation of 14 NIJ-funded geospatial tools (Wong, Sorensen, and Hollywood, 2014)

- *LPR*: automated LPR study (Gierlack et al., 2014)
- *RMS/CAD*: RMS/CAD/information-sharing study (Winkelman and Hollywood, unpublished)
- *IT investments*: logical model (and exploratory statistical analysis) identifying how IT investments and associated practices might lead to improved law enforcement outcomes—notably, improved clearance and crime rates (Jackson et al., 2014)
- *gap analysis*: supply and demand analysis
- *conference*: major problem statement from a law enforcement association conference
- *IT summit*: needs from the IACP/LEIM IT Summit—2013.
- priority ranking (“Priority”), from 1 to 9, 9 is high; roughly speaking, Tier 1 needs are those with ranks in the top third (7–9), Tier 2 needs are those with ranks in the middle third (4–6), and Tier 3 needs are those with ranks in the bottom third (1–3); each tier roughly corresponds to needs ranked in the top, middle, or bottom third, although there are differences for particular studies.¹

As mentioned, Table 2.1 does present all the needs, but it does not present every field we generated for each need. The full database is available as an electronic appendix to this report.²

The section following Table 2.1 presents analyses of how the needs support specific technology taxonomy categories and law enforcement objectives.

Table 2.1
Technology Needs for Law Enforcement

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Reduced-cost homeland security supplies	Need to reduce the cost of the supplies necessary to respond to major incidents, so that purchases made in the interest of preparedness put as little strain on the budget as possible	Facility Operations Technologies	Organizational Logistics	LEAP Tactical	3
Scheduling and staffing tool to improve quality of life	Tool to overcome issues with current quality of life for the practitioner, difficult personnel decisions for the managers, and customer service for citizens	Information Analysis	Computational Tools	Modeling and Simulation TWG	7

¹ Needs from the LEAP are marked according to the rules in the prior chapter. Needs from the initial interviews, gap analysis, and major conference issues are the top findings from those studies and thus are all Tier 1. Needs from the IACP/LEIM IT Summit—2013 are prioritized by the number of participants who thought it was their agency’s top issue and are divided into thirds. Needs from the technical assessment studies (econometric model, predictive policing, LPR, tool evaluation) were not prioritized and thus are labeled Tier 2 (Rank 5) by default.

² Other fields for needs in the full database include more details about the source study for the need (including breakout group for advisory panels), crosscutting theme to which the need contributes (if applicable), normalized value score, and a rating with respect to how much the need contributes to each law enforcement objective (LEAP needs only).

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Early warning system for officer emotional state	Need an early warning system for the emotional well-being of LE officers; this would monitor an officer's psychological condition, particularly after a traumatic incident, such as a shooting	Information Analysis	Computational Tools	LEAP Tactical	6
Lower-cost predictive policing tools	Need to provide predictive analytics tools that are affordable and comparatively easy to use by law enforcement	Information Analysis	Computational Tools	Predictive Policing	5
Crime-linking tool	Existing tools require that users initiate queries to discover linked crimes (need a more proactive tool)	Information Analysis	Computational Tools	Geospatial TWG	5
Nonpolicing data study	Need to use school, 911/311/health, and fire data as crime indicators or for analysis (need a survey on the use of these data)	Information Analysis	Individual Analytical Methods	Geospatial TWG	8
Decision support tools using predictions	Need to develop tools that use predictive policing predictions to advise resource planning and other strategic decisions	Information Analysis	Individual Analytical Methods	Predictive Policing	5
Visual representations and models for resource allocation	No bundled "model" for new chiefs/commanders to use as a guide to make decisions on the most efficient choices for operations	Information Analysis	Individual Analytical Methods	Modeling and Simulation TWG	5
Research on going from predictions to decision support	Need research to advance predictive policing from simple predictions to making inferences that explain crimes, recommend deployment strategies, and recommend intervention strategies	Information Analysis	Individual Analytical Methods	LEAP Operational	4
Better methods to select LE recruits	Need a better way to identify the qualities that translate into effective police work and use them as criteria in selecting candidates for training	Information Analysis	Individual Analytical Methods	LEAP Tactical	2
Better methods for matching people to LE roles	Need a better way to assess the skills of LE personnel and assigning them to "best-fit" roles within an agency	Information Analysis	Individual Analytical Methods	LEAP Tactical	1
Methods for predicting LE retention	Need a better way to screen prospective recruits and eliminate those who are unlikely to make it through the police academy	Information Analysis	Individual Analytical Methods	LEAP Tactical	1

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Study on 911 and 311 geospatial capabilities	Need a study on the maturity of 911/311 GIS analytic capabilities and processes; there is untapped potential for small and rural departments that lack crime-mapping and GIS capabilities to partner with regional and county centers	Information Analysis	Organizational Analytical Structures	Geospatial TWG	7
Provide in-field tactical analysis support	Need in-field analysis support; an officer would be able to stay in communication with a professional analyst, who would mine many different sources of data to deliver useful information to the officer in real time	Information Analysis	Organizational Analytical Structures	LEAP Tactical	6
Study on exploiting social media	Need to develop best practices and lessons learned for community-based information (social media) to enter criminal justice case files	Information Collection (Including Surveillance)	Community Interaction Tools	Information-Led Policing TWG	6
Improved tools to capture/assess social media	Need improved methods and tools to capture and analyze social media communications, including improved channels to get access to nonpublic communications	Information Collection (Including Surveillance)	Community Interaction Tools	LEAP Operational	2
Deployable systems for crime-scene documentation	Need a deployable device for crime scene documentation; this device would help gather and organize evidence so that a compelling evidence package could be prepared for a district attorney	Information Collection (Including Surveillance)	Field Analytic Tools	LEAP Tactical	4
Restructuring for computer crimes	Lack of capabilities and valid measures for computer crime; need information to determine the scope of the problem; need systems that can document crimes	Information Collection (Including Surveillance)	Field Analytic Tools	Operations Research TWG	1
Light wearable cameras	Need wearable cameras, as light as possible, to document interactions between officers and the public	Information Collection (Including Surveillance)	Internal Data Collection	LEAP Tactical	9
Deployable, wearable tracking systems (GPS)	Need a personnel-level tracking system; this would not need to be operational during day-to-day operations; following a major disaster or large event, the system would be activated and used in response coordination	Information Collection (Including Surveillance)	Internal Data Collection	LEAP Tactical	9

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
IT for personnel deployment tracking/management	Need a deployment management tool that provides data on an officer's location and the length of time in the field; this would help coordinate positioning and arranging for relief as officers approach the ends of shifts	Information Collection (Including Surveillance)	Internal Data Collection	LEAP Tactical	6
Standard policies and procedures for in-car/body-worn cameras	Need standards, policies, and procedures for in-car and body-worn cameras, including privacy, storage management, and facilitating officer/union acceptance	Information Collection (Including Surveillance)	Internal Data Collection	LEAP Operational	6
Privacy and civil rights policies for sensor systems	Need to create standard, defensible, privacy and civil rights policies for LPR and other sensor technologies as they come under increasing legal and political pressure	Information Collection (Including Surveillance)	Surveillance	Conference Themes	9
Standard policies, procedures, and assessments for video surveillance	Need to develop standard policies, procedures, and assessments for surveillance systems, on topics including storage, retention, privacy, partnerships, analytics, and system interoperability	Information Collection (Including Surveillance)	Surveillance	LEAP Operational	9
Deployable, near-real-time field biometrics	Need a deployable biometric device that can identify a person in under five minutes	Information Collection (Including Surveillance)	Surveillance	LEAP Tactical	8
Deployable electronic evidence collection	Need a deployable electronic evidence-collection tool that could pull pictures, video, or other evidence from witnesses' phones; the device would need to do this quickly, to prevent witnesses from leaving the scene	Information Collection (Including Surveillance)	Surveillance	LEAP Tactical	8
Dispatchable/deployable CCTV systems	Need a reliable system for area surveillance; these might include both on-site CCTV cameras (installed by police departments or local businesses) and/or UAVs	Information Collection (Including Surveillance)	Surveillance	LEAP Tactical	6
Access to cameras and surveillance equipment	Need cameras and surveillance equipment	Information Collection (Including Surveillance)	Surveillance	Agency Interviews	6
Model LPR data-sharing policies	Need to develop model memoranda of understanding for agencies to share LPR data	Information Collection (Including Surveillance)	Surveillance	LPR Study	5

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Model LPR privacy policies	Need to develop model privacy policies for LPR systems, with configurable sections depending on use cases	Information Collection (Including Surveillance)	Surveillance	LPR Study	5
Online cost-benefit analysis tool for LPR	Need an online tool to calculate the costs (acquisition, implementation, and maintenance) and benefits (crime deterrence) of LPR; the calculator should use local information to customize the benefits and costs	Information Collection (Including Surveillance)	Surveillance	LPR Study	5
Tradeoffs between privacy and utility for LPR use cases	Need a risk taxonomy that assesses tradeoffs between privacy rights and potential LE utility for different use cases for LPR	Information Collection (Including Surveillance)	Surveillance	LPR Study	5
Standardized video time-tagging systems	Need a standardized way to tag officer-collected electronic evidence with time stamps, so that evidence can be easily retrieved when necessary	Information Collection (Including Surveillance)	Surveillance	LEAP Tactical	4
Offender GPS data analysis tool	Criminal justice practitioners need to exploit currently available geospatial data and sensor technologies to full effect to manage/ supervise offenders	Information Collection (Including Surveillance)	Surveillance	Geospatial TWG	4
Positive ID and information on persons encountered	Need positive identification and information on persons encountered by police	Information Collection (Including Surveillance)	Surveillance	Technology Summit	3
Call exploitation tool	LE needs to not lose the criminal intelligence within communications (emails, telephone calls) between inmates and other individuals	Information Collection (Including Surveillance)	Surveillance	Geospatial TWG	3
Make social media easy for police departments to use	Need a way to make it easy for police departments to use social media to keep the public informed of developments; examples might include Facebook and Twitter feeds to direct readers to web pages of official information	Information Delivery (Including Communications)	External Communications	LEAP Tactical	9
Study on criminal justice-to-public communications	Need an evidence-based study of the effectiveness of the capture, processing, and delivery of communication between the criminal justice community and the public using new technologies	Information Delivery (Including Communications)	External Communications	Information-Led Policing TWG	8

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Public information channels to warn the public away from areas	Need information channels that would warn the public away from specified areas (due to police activity, hazardous material spills, etc.); “reverse 911 calls” are an example of this	Information Delivery (Including Communications)	External Communications	LEAP Tactical	8
Victim notification systems: inmate releases	Need a system that automatically notifies a victim of a prisoner’s release via either email, text message, or phone call; this could be a service that the victim signs up for at the time that the prisoner is sentenced	Information Delivery (Including Communications)	External Communications	LEAP Tactical	4
Programs to train civilians for incident management	Need to develop programs to establish roles for, train, and certify civilian volunteers to assist in major incident and event management	Information Delivery (Including Communications)	External Communications	LEAP Operational	4
Standard processes and tools for media dissemination	Need standard processes and tools to create and disseminate key bulletins and other content (video, etc.) internally, to the media, and to political officials	Information Delivery (Including Communications)	External Communications	LEAP Operational	4
Programs to educate public on how to interact with law enforcement	Need a “citizen academy” or some type of social media initiative to educate the public on interacting with police officers safely	Information Delivery (Including Communications)	External Communications	LEAP Tactical	3
Monitor/use new applications, etc., used by the public	Need a better way to identify how the public is getting its information, applications, websites, etc., and make use of it; law enforcement needs to “get out in front” of disinformation or information that would help criminals evade capture	Information Delivery (Including Communications)	External Communications	LEAP Tactical	2
Control/limit releases of information on social media	Need the ability to control the release of information by law enforcement personnel on social media to prevent unauthorized disclosure of information related to an ongoing case or otherwise harmful to a department	Information Delivery (Including Communications)	External Communications	LEAP Tactical	1
Standing common operational picture systems	Need to develop common operational picture systems, with supporting databases, to support incident and event response, and day-to-day command and control; these must be affordable and support mobile applications	Information Delivery (Including Communications)	Information Presentation Tools and Dashboards	LEAP Operational	9

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Geospatial capability survey	Need to become aware of the nature and maturity of current geospatial capabilities across the United States (need a new capabilities survey)	Information Delivery (Including Communications)	Information Presentation Tools and Dashboards	Geospatial TWG	9
Greater R&D investment in common operational pictures	Need greater investment in common operational picture–related RDT&E, given a 5 percentage point average gap between needs and systems/awards	Information Delivery (Including Communications)	Information Presentation Tools and Dashboards	Supply-Demand Analysis	9
Assess how to use new IT/maps/displays in COMPSTAT	Need an assessment of how to use new IT/mapping/display capabilities and new developments in organizational improvement techniques to improve COMPSTAT	Information Delivery (Including Communications)	Information Presentation Tools and Dashboards	LEAP Operational	7
Improvements and automations to COMPSTAT	Need a standard tool that automatically generates statistics, geospatial data, and other information needed for a range of COMPSTAT and decision support systems	Information Delivery (Including Communications)	Information Presentation Tools and Dashboards	LEAP Operational	5
Predictive policing tools showing situational awareness	Need predictive policing systems that provide situational awareness through custom dashboards with displays, alerts, and drill-down capabilities to multiple levels	Information Delivery (Including Communications)	Information Presentation Tools and Dashboards	Predictive Policing	5
Video middleware	Need widespread automated video feeds integrated with the call-taking and dispatch process; a multitude of video feeds could be more efficiently used, but it is impossible to watch all cameras	Information Delivery (Including Communications)	Information Presentation Tools and Dashboards	Geospatial TWG	1
Improve communication infrastructure in general	Need improved communication infrastructure	Information Delivery (Including Communications)	Mobile Communications	Agency Interviews	7
Cross-agency radio communication interoperability	Need radio communications that are interoperable between agencies; in some cases, this could be expanded to include interoperability with firefighters and emergency medical services	Information Delivery (Including Communications)	Mobile Communications	LEAP Tactical	6

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Officer notification systems: inmate releases/activity	Need a notification system to keep officers apprised of the activities of current prisoners; officers could receive notifications of the in-facility activities of inmates and gangs of interest	Information Delivery (Including Communications)	Mobile Communications	LEAP Tactical	6
Extension of systems for in-field queries and reporting (e.g., ARJIS)	Need to extend the use of mobile systems, such as ARJIS, with functions including queries (to check on persons or vehicles), alerts (that a person or vehicle of interest has been contacted), and computer-aided field reporting; system data must be updated in near real time; mobile devices need to function in and out of connectivity	Information Delivery (Including Communications)	Mobile Communications	LEAP Tactical	6
Human-factors research on maximizing information value and reducing information overload	Need human-factors research into maximizing the value of information given to officers while minimizing information overload and permitting officers to keep eyes on their environment (e.g., on suspects, on the road while driving)	Information Delivery (Including Communications)	Mobile Communications	LEAP Operational	6
Geographic alert tool	Need to take full advantage of positional information (GPS-enabled, RFID, GeoRSS) technologies to promote officer safety and situational awareness	Information Delivery (Including Communications)	Mobile Communications	Geospatial TWG	6
Social media for criminal justice	Need a criminal justice social network site or application to bring the criminal justice community together	Information Delivery (Including Communications)	Mobile Communications	Information-Led Policing TWG	5
Improved bandwidth	Need sufficient bandwidth for in-car computers that any information can be transferred to and from officers in the field with minimal lag time	Information Delivery (Including Communications)	Mobile Communications	LEAP Tactical	4
Information overload study	Need to know the information needs of the officer at the lowest level, to include information overload and information quality	Information Delivery (Including Communications)	Mobile Communications	Information-Led Policing TWG	4
Rapid data offloads from car/officer cameras	Need a rapid and robust way to offload data from cars or officer-mounted cameras; the system would need to tolerate sporadic connections	Information Delivery (Including Communications)	Mobile Communications	LEAP Tactical	3

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Improve mobility and convergence in general	Need to improve mobility and convergence	Information Delivery (Including Communications)	Mobile Communications	Technology Summit	3
Evaluate the extent to which mobile technology is making policing more efficient	Need analysis to determine the impacts of mobile technology on policing	Information Delivery (Including Communications)	Mobile Communications	Operations Research TWG	3
Improve knowledge management systems (RMS, data exchange)	Need improved knowledge management (RMS, data exchange)	Information Management (Including Sharing)	IT for Mission-Related Data	Agency Interviews	7
Greater R&D investment in single-source digital evidence systems	Need greater investment in RDT&E on single-source (specialized) digital evidence systems, given a 2.9 percentage point average gap between needs and systems/awards	Information Management (Including Sharing)	IT for Mission-Related Data	Supply-Demand Analysis	7
Improve information management in general	Need better information management	Information Management (Including Sharing)	IT for Mission-Related Data	Technology Summit	1
Routing system for approvals and paperwork	Need to establish a routing system for report approvals and similar paperwork; this would streamline administrative police work and minimize the amount of time officers spend on noncore mission activities	Information Management (Including Sharing)	IT for Organizational Resources	LEAP Tactical	6
Further develop and enforce RMS/CAD and other key criminal justice data standards	Need to further develop RMS/CAD data interoperability standards along with testing, certification, and enforcement mechanisms for compliance; standards should explicitly include metadata and image-sharing and should further existing standards rather than disregard them	Information Management (Including Sharing)	System Integration and Sharing	LEAP Operational	9
Greater R&D investment in IT standards	Need greater investment in RDT&E on IT standards, given a 4.2 percentage point average gap between needs and systems/awards	Information Management (Including Sharing)	System Integration and Sharing	Supply-Demand Analysis	8
Standardized definitions (for criminal justice performance measures and information exchange)	Need agreed-upon operational definitions and data standardization for criminal justice performance measures and information exchange	Information Management (Including Sharing)	System Integration and Sharing	Operations Research TWG	7

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Federal leadership in improving interoperability	Need to improve interoperability, and the federal government should play a leading role in doing so	Information Management (Including Sharing)	System Integration and Sharing	Agency Interviews	7
Study on regional and interagency information-sharing	Need an evidence-based study of the information-sharing capabilities that state and local criminal justice communities are using and assess the operational effectiveness of those systems	Information Management (Including Sharing)	System Integration and Sharing	Information-Led Policing TWG	7
Improve the interoperability of NIJ-funded software tools	Need to improve the interoperability of NIJ-funded software tools, possibly by creating a common database to store data to be used by a wide array of analytic tools	Information Management (Including Sharing)	System Integration and Sharing	Tool Evaluation	5
Greater resources, local leadership, for N-DEX	Need greater state and local involvement in N-DEX, along with resources and mandatory policies to further states' sharing with N-DEX	Information Management (Including Sharing)	System Integration and Sharing	LEAP Operational	3
Offender information-sharing	Need to share information about offenders between probation, prosecution, and police, including for juveniles	Information Management (Including Sharing)	System Integration and Sharing	Information-Led Policing TWG	3
Domestic violence information-sharing	Need to share domestic violence data between criminal justice and human services on a national level	Information Management (Including Sharing)	System Integration and Sharing	Information-Led Policing TWG	2
Video exploitation tool	Lack of integration of various data sources results in the inability of video analytics to be fully exploited; need to determine what data are available (facial, tattoos, LPRs, etc.) and what tools are currently available	Information Management (Including Sharing)	System Integration and Sharing	Geospatial TWG	2
Examine barriers to NIBRS implementation	Need an assessment to examine barriers to NIBRS implementation, to include technical concerns, updated requirements, funding, and assistance required to support nationwide implementation	Information Management (Including Sharing)	System Integration and Sharing	LEAP Operational	1
Obtain data from public agencies besides law enforcement	Need the ability to obtain data from public utilities, public health, and other public and private agencies to support crime analysis	Information Management (Including Sharing)	System Integration and Sharing	LEAP CA/Inv	1
Lower technology life-cycle costs in general	Need low [technology] life-cycle cost	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Agency Interviews	9

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Improve alignment of strategic requirements with technology	Need to align strategic requirements with available technical capabilities	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Technology Summit	9
Mechanisms to address major budget cuts	Need to address critical budget cuts driven by the recession; technology seen as both a potential help and a cost to be cut	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Conference Themes	9
Greater R&D investment in process improvement	Need greater investment in process improvement—related RDT&E, given an 18.2 percentage point average gap between needs and systems/ awards	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Supply-Demand Analysis	9
Training leaders for resiliency	Need to develop standard procedures to train supervisory and management personnel to address resiliency, to include leadership, personality types and motivations, and human and technology resources	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	LEAP Operational	8
Quantify how wellness program improves quality of operations	Need evidence to back up implementation of on-duty wellness programs, way to measure their success, and data	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Operations Research TWG	8
Improve budget situations in general	Need to improve budgets	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Technology Summit	8
Checklists for handling critical, infrequent crimes	Need to provide checklists and process guides for major (but infrequent) crimes, incidents, and events	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	LEAP CA/Inv	7
Reference MOUs for multiagency response	Need to develop reference policies and MOUs for multiagency response to major incidents and events	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	LEAP Operational	7
Models, resources, and examples for health programs	Need to identify models, resources, and example implementations of wellness programs (general health/ fitness, mental health, trauma response)	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	LEAP Operational	7
Quantifying appropriate workload	Need assessment literature that guides appropriate workload standards	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Operations Research TWG	6
Improve policies and procedures relating to technology in general	Need policies and procedures relating to technology	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Technology Summit	6

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Authoritative tool to locate criminal justice experts	Need an authoritative tool to find practitioners with specific and current expertise; examples might include biographies in an OJP-sponsored database or a site analogous to LinkedIn to provide peer-reviewed capabilities	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	LEAP CA/Inv	5
Guide to predictive policing	Need guide on what predictive policing is, what works, and what does not in predictive policing, to include standards on concepts, models, and evaluation paradigms	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	LEAP Operational	5
Data on IT investments and practices	Need to collect detailed data on agencies' investments in IT and practices, capturing what the investments were and when they were made	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	IT Investment	5
Models of change management	Need knowledge about how to best implement change in a criminal justice agency	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Operations Research TWG	5
Guide on improving public trust and legitimacy	Need to develop a guide on approaches to improving public trust and legitimacy, as well as get support for additional revenue when needed	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	LEAP Operational	2
Model existing practices within law enforcement	Need to understand key factors of current practices that drive outcomes and consistent outcome measures to justify decisions	Management/ Knowledge Development and Training	Management/ Leadership Knowledge	Operations Research TWG	2
Repository of best practices with supporting evidence and tools	Need a repository of best practices in criminal justice (expanding on currently available guides, such as the POP guides), along with supporting R&E evidence and supporting data and views	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	LEAP CA/Inv	9
Alternatives to mass stops and arrests	Need to develop and disseminate alternative proactive interventions as mass stop-and-frisk and arrests (especially for low-level narcotics offenses) come under increasing political and legal pressure	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	Conference Themes	9
Proactive/preventive measures for incident/stress management	Need education in the areas of stress management to proactively identify signs of stress and mitigate its effects	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	Modeling and Simulation TWG	9

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
POP guides for change management	Need centralized location with useful information and guidance for practitioners on change management	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	Operations Research TWG	9
R&E to reduce crime from repeat offenders	Need R&E on practices to reduce crime from repeat offenders, especially methods that do not require continual rearrest and incarceration	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	LEAP Operational	8
Retention of legacy knowledge	Need to effectively and efficiently retain the corporate knowledge of long-time employees; when they leave agencies, they take away valuable knowledge that is not documented by the agency	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	Operations Research TWG	8
Greater R&D investment in officer health	Need greater investment in officer health-related RDT&E, given a 4.2 percentage point average gap between needs and systems/awards	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	Supply and Demand Analysis	8
R&E to reduce crime at high-volume places	Need R&E on practices to reduce crime at places with high volumes of crime, such as “big box” stores, apartments, convenience stores, bars, and motels	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	LEAP CA/Inv	6
Models for identifying those on whom to focus criminal justice sanctions	Need to improve and disseminate risk models that can help police departments determine those on whom to focus most criminal justice efforts and sanctions to most limit harm from crime	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	LEAP Operational	6
Situational awareness training for the field	Need training on how to get information needed to define a problem, what to look for, which systems to use, what information is most critical, and how to get it “down to the edge”	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	Modeling and Simulation TWG	6
R&D on predictive policing interventions	Need additional R&D on interventions using predictive policing forecasts	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	Predictive Policing	5
Evaluation of predictive policing interventions	Need additional evaluation on interventions using predictive policing forecasts	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	Predictive Policing	5

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Predict the impact that policing operations changes can have on crime outcome	Need data on how crime rates might be affected by changes in policing impacts (especially reductions) on crime rates, to include separating confounding variables	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	Operations Research TWG	5
Training to reduce use of force	Need additional training for LE personnel to reduce unnecessary use-of-force incidents and complaints; training could involve hands-on simulations of ambiguous situations or other web-based training tools	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	LEAP Tactical	4
Policies/laws to preempt online “gang-banging”	Need to develop model policies and laws to preempt online “gang-banging” activity, including recruitment and violent threats (e.g., extend existing gang-injunction law to online activity)	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	LEAP Operational	3
Guide on assessing/ coordinating with public housing	Need to develop a guide on the impact that public housing can have on crime and improving coordination with public housing authorities to reduce crime and disorder	Management/ Knowledge Development and Training	Officer/ Practitioner Knowledge	LEAP Operational	2
Privacy and civil rights policies for predictive policing	Need to develop common privacy and civil rights policies for predictive policing	Management/ Knowledge Development and Training	Societal/Legal Knowledge	Predictive Policing	5
Standard policies and procedures for new technologies in general	Need to develop a “meta policy” to provide “standard” advice to departments on how to use a new technology (sensors, surveillance, and networking) before a specific policy is developed	Management/ Knowledge Development and Training	Societal/Legal Knowledge	LEAP Operational	1
Increase collaboration with associations	Need to increase collaboration with professional associations and conferences, which are primary sources of technology information	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Agency Interviews	9
Guidance and support for cybersecurity	Need to provide guidance and support to agencies to secure their data and networks from cyberthreats, given that half of agencies report that they have inadequate protections	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Conference Themes	9
Criminal justice information repository	Create a central, practitioner-friendly location for information-sharing, best practices, technologies, and applications	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Information-Led Policing TWG	9

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Improve federal technology outreach (NLECTC, JUSTNET org, etc.)	Need to improve federal outreach efforts on technology (i.e., there is little/no knowledge of NLECTC)	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Agency Interviews	8
Improve program management of technology resources in general	Need program management of technology resources	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Technology Summit	8
R&E to reduce high-volume crime	Need R&E on practices to reduce crimes that occur frequently, such as domestic violence, false alarms, cell phone theft, and metal theft	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	LEAP CA/Inv	7
Training on social media tools and capabilities	Need training on social media, including what can be gathered (with/without a court order), and how to gather it (including working with different social media companies)	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	LEAP Operational	7
Better address exponential growth in technology and data	Need to address the exponential growth in technology and resulting data	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Technology Summit	7
Accurate publicity on predictive policing tools	Need to clarify the capabilities and uses of predictive policing tools, as well as limit the hype that these systems can predict the future	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Predictive Policing	5
Testing and reporting on predictive policing tools	Need testing and reporting on available predictive policing tools, similar to that done in <i>Consumer Reports</i>	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Predictive Policing	5
Reporting on use of predictive policing tools	Need reporting on who is using predictive policing tools, how, with what training, and with what impacts	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Predictive Policing	5
Information-sharing framework	Need to further support an emerging framework for information-sharing, including core architectural elements, a core data model with tailored interfaces, SDKs, testing, and certification	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	RMS/CAD	5
Model language for RMS/CAD RFPs	Need further development of model RFP language for RMS/CAD, addressing framework compliance, testing and certification, information assurance, and privacy and civil rights provisions	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	RMS/CAD	5

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Affordable business models for RMS/CAD	Need further support and dissemination of new, more affordable business models for RMS/CAD, including software-as-a-service, cloud, and regional licensing models	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	RMS/CAD	5
Improve dissemination of NIJ-funded software tools	Need to improve the dissemination of NIJ-funded software tools, to include specifying tool repositories and requiring creation and execution of dissemination plans	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Tool Evaluation	5
Improve NIJ policy on software tool development	Need to improve NIJ policy and involvement in software tool development, to include requiring delivery of a working tool, increasing oversight of technical decisions, and specifying responsibilities for dissemination, ongoing maintenance, and improvements to fix shortfalls	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Tool Evaluation	5
Improve life-cycle management of technology in general	Need life-cycle management of technology	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Technology Summit	5
Policy, security, acquisition standards for cloud	Need to develop policy, security, business process, and acquisition standards for using cloud architectures in law enforcement	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	LEAP Operational	4
Uniform curriculum/certification for analysts	Need to develop uniform curriculum and certification standards with graduated proficiency levels for crime analysts	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	LEAP CA/Inv	4
Improve knowledge of current technology developments	Need to keep current on technological developments	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	Technology Summit	4
Research on improvements to data sources and models	Need research on improvements to data sources, models, deployments/ interventions (types/dosage), and criminal and community responses	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	LEAP Operational	3
Authoritative tool to locate government-funded technology	Need an authoritative tool to point to government-funded criminal justice technology solutions	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	LEAP CA/Inv	3

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
News service to explain new technologies and implications	Need a news service" to announce and explain new technologies, along with potential positive and negative implications	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	LEAP Operational	1
Specifications for analysts' roles in critical incidents	Need to develop formal specifications of analysts' roles during critical incidents	Management/ Knowledge Development and Training	Specialist/ Technologist Knowledge	LEAP CA/Inv	1
Deficiency in skill sets tool	Need uniform testing or evaluation tools to determine officers' overall skill sets and deficiencies	Management/ Knowledge Development and Training	Technology-Mediated Teaching	Modeling and Simulation TWG	8
Better LE training for multiagency/unified command response	Need improvements to unified command training, to include awareness and use of NIMS; these should consider new technologies (exercises, simulators, and gaining), as well as support agency-specific customization	Management/ Knowledge Development and Training	Technology-Mediated Teaching	LEAP Operational	7
Simulation-based management tool for operational guidelines for commanders	Need a simulation-based management tool on the operational application of publicized guidelines (e.g., BJA Police Desk Reference) for command-level law enforcement on day-to-day operations	Management/ Knowledge Development and Training	Technology-Mediated Teaching	Modeling and Simulation TWG	4
Virtual realities (such as FBI, CSI)	Need more, flexible, customizable, and cost-effective virtual reality training	Management/ Knowledge Development and Training	Technology-Mediated Teaching	Modeling and Simulation TWG	2
Surveillance- and observation-based instruction in a virtual environment	Need to overcome deficiencies in virtual training that would allow training personnel on observational skills (e.g., grow fields, meth lab recognition)	Management/ Knowledge Development and Training	Technology-Mediated Teaching	Modeling and Simulation TWG	1
Cost-effective "realistic" firearms training	Need cost-effective but realistic firearms training; this could involve the use of simunitions, paintballs, airsoft weapons, or other training tools	Management/ Knowledge Development and Training	Tools to Assist Live Training	LEAP Tactical	3
More advanced high-liability, role-playing technology	Need to overcome problems in which there is a loss of verbal/nonverbal capabilities in exercises due to thick protective equipment that blocks movement	Management/ Knowledge Development and Training	Tools to Assist Live Training	Modeling and Simulation TWG	3

Table 2.1—Continued

Need	Need Description	Technology Taxonomy Division	Technology Taxonomy Category	Source	Priority
Combine/reduce weight of multiple devices	Need to combine the functions of the equipment that police use in day-to-day operations into the smallest number of devices that can be kept as light as possible, to minimize their impact on an officer’s duties	Personnel Clothing, Protection, or Augmentation	Duty Technology	LEAP Tactical	2
New nonlethal options	Need nonlethal alternatives to add to the current stock of police equipment, notably weapons that could be used in situations where pepper spray or a Taser would be inadvisable	Weapons and Force	Less-Than-Lethal Weapons	LEAP Tactical	2

Support for Technology Areas and Law Enforcement Objectives

In this section, we analyze how the needs cover technology areas (reflected by the taxonomy) and the law enforcement objectives.

Coverage of Technology Areas

Figure 2.1 shows the number of needs by taxonomy division (top level). Not surprisingly, a majority of needs fall under the technical “information” divisions. However, a large proportion of needs actually fall under the nontechnical aspects of IT: management and technical knowledge development and training. A handful of needs fall under other divisions.

Figure 2.1
Number of Needs, by Technology Taxonomy Division

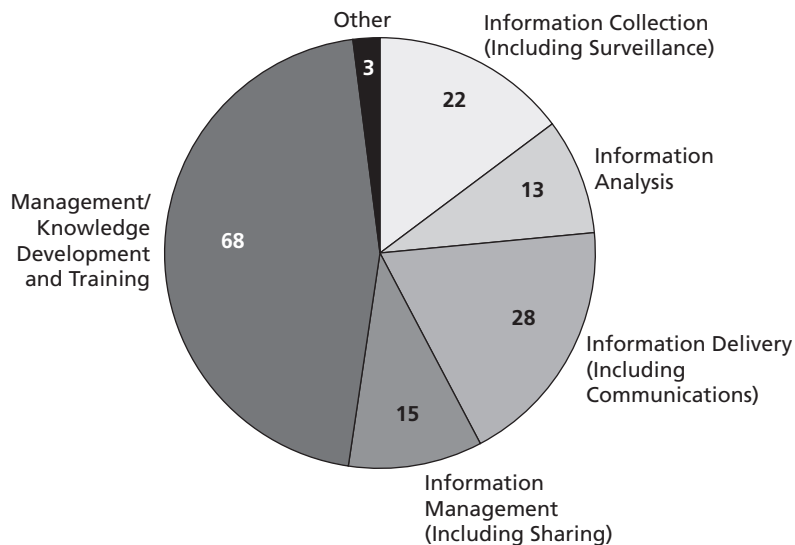


Figure 2.2 shows the specific breakdown of needs to specific technology categories. As shown, the highest numbers of needs apply to the knowledge development and training categories—specialist/technologist, management/leadership, and officer/practitioner. Following these three, the categories with the next-highest numbers of needs were technical, having to do with surveillance, mobile communications, and systems integration and information-sharing.

For practitioners, developers, and funders with specialized technical interests, Table 2.2 shows the top needs under each information taxonomy division, as well as the top needs under knowledge dissemination and training. Figure 2.3 shows the average need bin number for each law enforcement objective.

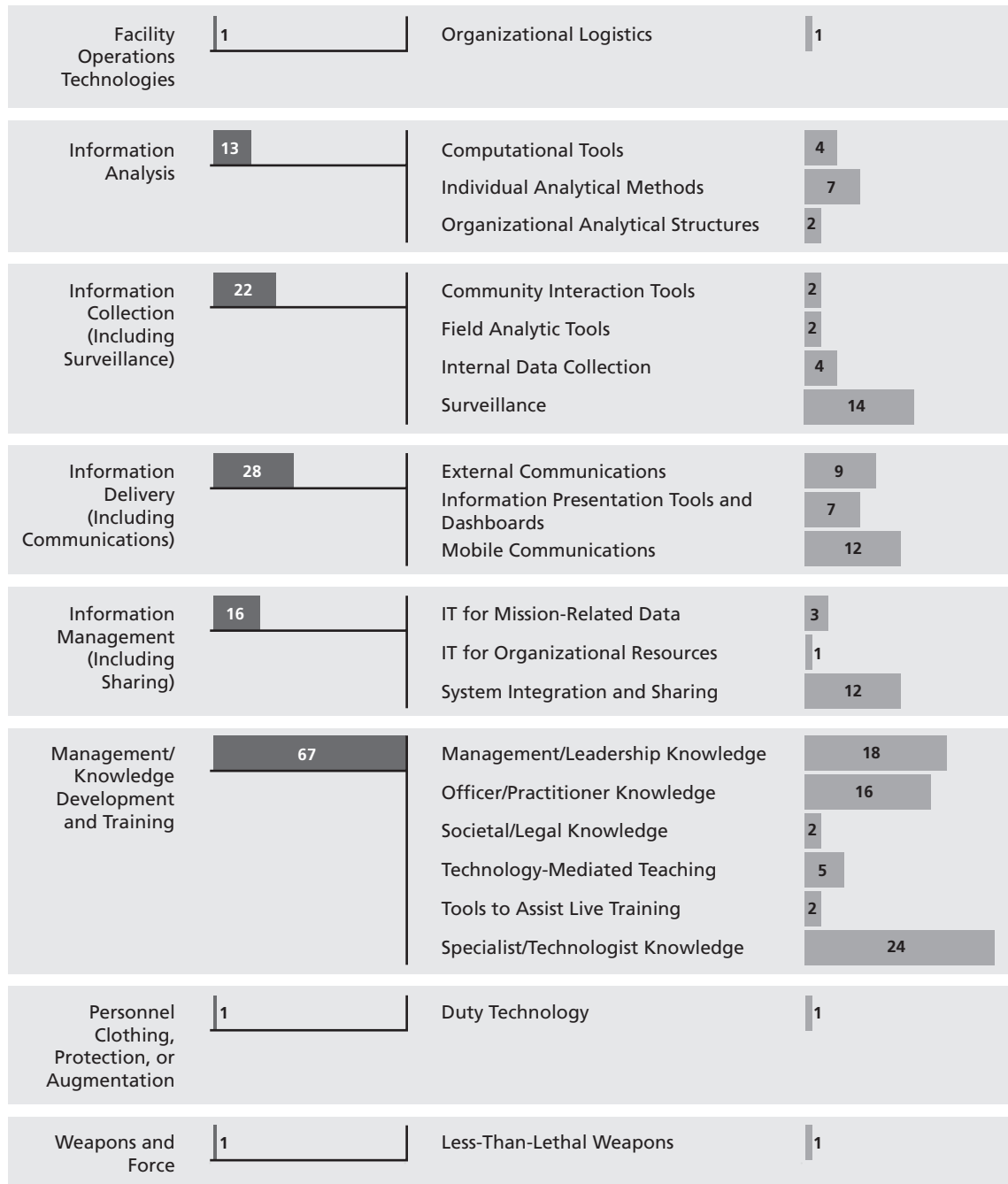
Coverage of Law Enforcement Objectives

In the previous chapter, we explained how we calculated overall expected value scores for each LEAP need (potential benefit with respect to each objective times the likelihood of technical success times the likelihood of operational success). We then divided the scores into ninths, giving each need an overall rating from 1 to 9 (9 is the highest). We also calculated expected values with respect to each individual objective and binned those scores into ninths as well, so that each LEAP need has one rating from 1 to 9 reflecting how well it supports each of the eight law enforcement objectives.

For the LEAP needs alone, Table 2.2 presents the average of the ratings across all needs for each objective. As shown, Reduce Costs, Reduce Crime and Disorder, Improve the Public's Trust in Law Enforcement, and Improve Competencies are all well covered by the needs from the LEAP, with the average bin rating being over 5 (the middle bin number). However, the average bin rating for Solve More Cases was under 4, and the ratings for Improve Health and Improve Safety were barely over 3, meaning that most LEAP needs provided little support to these objectives.

For practitioners, developers, and funders with special interests in meeting particular objectives, Table 2.3 shows the top needs for each objective. The table also shows the overall bin rating for each need as well as the specific bin rating for that objective. As shown, all specific bin ratings had top values (9) except for Solve More Cases.

Figure 2.2
Number of Needs, by Technology Category



NOTES: Information Analysis, Information Collection, Information Delivery, and Information Management are all part of the larger “Information and Communications Technology (ICT)” top-level category on the Criminal Justice Technology Taxonomy introduced in Figure 1.1. We present the counts of needs by each subcategory of ICT to provide more detail, since this report focuses on IT needs for law enforcement. In all, there were 79 ICT needs across the four subcategories.

Table 2.2
Top Needs, by Technology Area

Division	Title	Description	Overall
Information Analysis	Nonpolicing data study	School, 911/311/health, and fire data are not currently being used as crime indicators or for analysis (need a survey on the use of these data).	8
	Scheduling and staffing tool to improve quality of life	Tool to overcome issues with current quality of life for the practitioner, difficult personnel decisions for the managers, and customer service for citizens	7
	Study on 911 and 311 geospatial capabilities	Lack of knowledge about the maturity of 911/311 GIS analytic capabilities and processes; there is untapped potential for small and rural departments that lack crime-mapping and GIS capabilities to partner with regional and county centers (need to study 911/311 geospatial capabilities)	7
Information Collection (Including Surveillance)	Light wearable cameras	Need wearable cameras, as light as possible, to document interactions between officers and the public	9
	Privacy and civil rights policies for sensor systems	Need to create standard, defensible privacy and civil rights policies for LPR and other sensor technologies as they come under increasing legal and political pressure	9
	Deployable, wearable tracking systems (GPS)	Need a personnel-level tracking system; this would not need to be operational during day-to-day operations; following a major disaster or large event, the system would be activated and used in response coordination	9
Information Delivery (Including Communications)	Standing common operational picture systems	Need to develop common operational picture systems, with supporting databases, to help with incident and event response and day-to-day command and control; these must be affordable and support mobile applications	9
	Geospatial capability survey	Criminal justice community is unaware of the nature and maturity of current geospatial capabilities across the United States (need a new capability survey).	9
	Make social media easy for police departments to use.	Need a way to make it easy for police departments to use social media to keep the public informed of developments; examples might include Facebook and Twitter feeds to direct readers to web pages of official information.	9
Information Management (Including Sharing)	Further develop and enforce RMS/CAD and other key criminal justice data standards	Need to further develop RMS/CAD data interoperability standards and testing, certification, and enforcement mechanisms for compliance; standards should explicitly include metadata and image-sharing and should further existing standards rather than disregard them	9
	Standardized definitions (for criminal justice performance measures and information exchange)	Lack of agreed-upon operational definitions and data standardization for criminal justice performance measures and information exchange	7
	Improve knowledge management systems (RMS, data exchange)	Desire for improved knowledge management (RMS, data exchange)	7
Management/ Knowledge Development and Training	Repository of best practices with supporting evidence and tools	Need a repository of best practices in criminal justice (expanding on currently available guides, such as the POP guides), along with supporting R&E evidence and supporting data and views	9
	Lower-technology life-cycle costs in general	Desire for low [technology] life-cycle cost	9
	Increase collaboration with associations	Professional associations and conferences are primary sources of technology information (i.e., increase collaboration with associations)	9

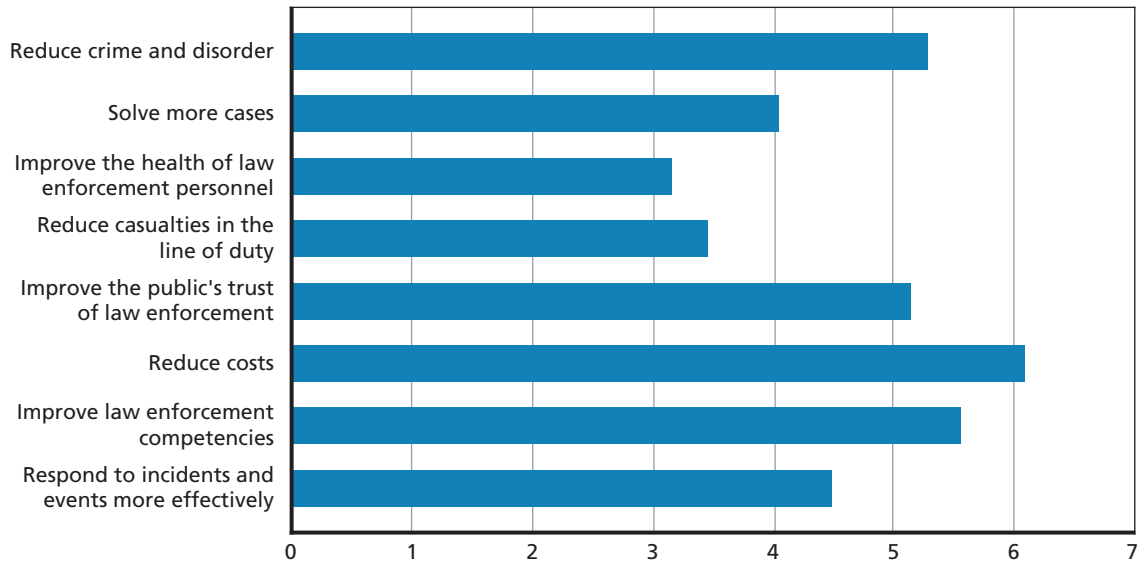
Table 2.3
Top Needs for Each Law Enforcement Objective

Objective	Title	Description	Overall Rating	Objective Rating
Reduce Crime and Disorder	Repository of best practices with supporting evidence and tools	Need a repository of best practices in criminal justice (expanding on currently available guides, such as the POP guides), along with supporting R&E evidence and supporting data and views	9	9
	Standing common operational picture systems	Need to develop common operational picture systems, with supporting databases, to support incident and event response and day-to-day command and control; these must be affordable and support mobile applications	9	9
	Further develop and enforce RMS/CAD and other key criminal justice data standards	Need to further develop RMS/CAD data interoperability standards along with testing, certification, and enforcement mechanisms for compliance; standards should explicitly include metadata and image-sharing and should further existing standards rather than disregard them	9	9
Solve More Cases	Deployable, near-real-time field biometrics	Need a deployable biometric device that is capable of identifying a person in under five minutes	8	8
	Deployable electronic evidence collection	Need a deployable electronic evidence collection tool that could pull pictures, video, or other evidence from witnesses' phones; the device would need to do this quickly, to prevent witnesses from leaving the scene	8	8
	Dispatchable/deployable CCTV systems	Need a reliable system for area surveillance; these might include both on-site CCTV cameras (installed by police departments or local businesses) and/or UAVs	6	8
Improve the Health of Law Enforcement Personnel	Light wearable cameras	Need wearable cameras, as light as possible, to document interactions between officers and the public	9	9
	Deployable, wearable tracking systems (GPS)	Need a personnel-level tracking system; this would not need to be operational during day-to-day operations; following a major disaster or large event, the system would be activated and used in response coordination	9	9
	Models, resources, and examples for health programs	Need to identify models, resources, and example implementations of wellness programs (general health/fitness, mental health, trauma response)	7	9
Reduce Casualties in the Line of Duty	Light wearable cameras	Need wearable cameras, as light as possible, to document interactions between officers and the public	9	9
	Deployable, wearable tracking systems (GPS)	Need a personnel-level tracking system; this would not need to be operational during day-to-day operations; following a major disaster or large event, the system would be activated and used in response coordination	9	9
	Public information channels to warn public away from areas	Need information channels that would warn the public away from entering specified areas (due to police activity, hazardous material spills, etc.; reverse 911 calls are an example of this)	8	9
Improve the Public's Trust of Law Enforcement	Light wearable cameras	Need wearable cameras, as light as possible, to document interactions between officers and the public	9	9

Table 2.3—Continued

Objective	Title	Description	Overall Rating	Objective Rating
	Make social media easy for police departments to use	Need a way to make it easy for police departments to use social media to keep the public informed of developments; examples might include Facebook and Twitter feeds to direct readers to web pages of official information	9	9
	Standard policies, procedures, and assessments for video surveillance	Need to develop standard policies, procedures, and assessments for surveillance systems, on topics including storage, retention, privacy, partnerships, analytics, and system interoperability	9	9
Reduce Costs	Repository of best practices with supporting evidence and tools	Need a repository of best practices in criminal justice (expanding on currently available guides, such as the POP guides), along with supporting R&E evidence and supporting data and views	9	9
	Deployable, near-real-time field biometrics	Need a deployable biometric device that is capable of identifying a person in under five minutes	8	9
	Checklists for handling critical, infrequent crimes	Need to provide checklists and process guides for major (but infrequent) crimes, incidents, and events	7	9
Improve Law Enforcement Competencies	Repository of best practices with supporting evidence and tools	Need a repository of best practices in criminal justice (expanding on currently available guides, such as the POP guides), along with supporting R&E evidence and supporting data and views	9	9
	Training leaders for resiliency	Need to develop standard procedures to train supervisory and management personnel to address resiliency, to include leadership, personality types and motivations, and human and technology resources	8	9
	Checklists for handling critical, infrequent crimes	Need to provide checklists and process guides for major (but infrequent) crimes, incidents, and events	7	9
Respond to Incidents and Events More Effectively	Standing common operational picture systems	Need to develop common operational picture systems, with supporting databases, to support incident and event response and day-to-day command and control; these must be affordable and support mobile applications	9	9
	Further develop and enforce RMS/CAD and other key criminal justice data standards	Need to further develop RMS/CAD data interoperability standards along with testing, certification, and enforcement mechanisms for compliance; standards should explicitly include metadata and image-sharing and should further existing standards rather than disregard them	9	9
	Public information channels to warn public away from areas	Need information channels that would warn the public away from entering specified areas (due to police activity, hazardous material spills, etc.); reverse 911 calls are an example of this	8	9

Figure 2.3
Average Need Bin Number for Each Law Enforcement Objective



RAND RR737-2.3

Findings and Recommendations

All of the needs described in the previous chapter can be thought of as “individual recommendations,” in that all are drawn from direct practitioner input or technical studies and might inform a funder’s or developer’s decisions about which S&T efforts to pursue next. In this concluding chapter, we take a more holistic approach, looking across the needs to identify patterns and develop some overarching recommendations that come from the identified needs as a group.

We identify major themes in the law enforcement IT needs, and we also summarize, in general, what has been done related to these themes to date and recommend some potential ways forward to address them in the future. To identify themes, the center examined the Tier 1 needs (plus some additional near-Tier 1 needs from the LEAP¹) and, as mentioned in Chapter One, identified overarching themes linking groups of Tier 1 needs. The center identified 11 crosscutting themes in total. These themes themselves are further grouped into just three overarching keynotes—a broad need to improve the law enforcement community’s knowledge of technology and practices, a broad need to improve the sharing and use of law enforcement–relevant information, and a broad need to conduct RDT&E on a range of topics. The latter category includes research both on the nonmateriel side of technology, including policy and practices, and on more traditional technical development. Table 3.1 shows a high-level breakdown of all the themes and categories.

Broadly speaking, we make two kinds of recommendations with respect to the crosscutting themes. The first is when a technology area needs additional RDT&E, as shown by the number of related high-priority needs. The second is when a technology area needs additional coordination and dissemination, as shown by a combination of both a number of related high-priority needs and a number of disjointed efforts already under way to address the area.

The following sections discuss the themes and corresponding findings and recommendations in detail. We then conclude this chapter by summarizing the suggested ways ahead for all the themes. We also discuss ways ahead to identify and prioritize technology needs in the future and track how those needs are being addressed over time. The result of all of the above is an S&T road map for law enforcement IT.

¹ A fairly large set of needs from the LEAP tactical breakout group, and a few from the operational breakout group, had identical ratings right below the criteria for Tier 1; leaving out these needs would have left an underrepresentation of needs from these groups. We have included these near-Tier 1 needs in the crosscutting theme analysis, as well.

Table 3.1
Summary of Themes in Law Enforcement Needs

Keynote	Theme
A. Need to improve the law enforcement community's knowledge of technology and practices	1. Improve community knowledge of technology and technology practices 2. Improve the dissemination of best practices related to technology management and process improvement
B. Need to improve the sharing and use of law enforcement information	3. Improve the sharing of law enforcement information 4. Improve display and use 5. Improve mechanisms to communicate with the public
C. Need for other technology RDT&E	6. Improve health systems 7. Improve privacy, security, and civil rights policies 8. Improve the affordability of technology 9. Improve practices to reduce crime 10. Improve major event response technology 11. Improve deployable sensors

Keynote A: Improve the Law Enforcement Community's Knowledge of Technology and Technology Practices

The most important keynote from across all the top needs was not a requested technology. Instead, it was a general need to improve the law enforcement community's awareness of the most promising criminal justice practices and technologies. In addition to dissemination on specific technologies, needs in this category emphasized providing general guidance and support for agencies on technology management and "business process" improvement in general, helping agencies improve the efficiency and effectiveness of their operations and technology efforts.

Theme 1: Need to Improve the Law Enforcement Community's Knowledge of Technologies and Practices for Leveraging Technologies

Contributing needs:

- Increase collaboration with associations.
- Improve federal technology outreach (NLECTC, JUSTNET, etc.).
- Create a repository of promising practices with supporting evidence and tools.
- Maintain a criminal justice information repository.

The center received strong and repeated calls to improve the dissemination of knowledge about technology in general. Specific needs for doing this include having a federally sponsored repository of best practices and technology information; links to technology guides, information, and practice experts; and links to (or stores of) free and inexpensive tools. There was also a strong desire to work with law enforcement associations to better disseminate practices and technology awareness, given that agencies reported getting most of their technology information (other than sales information) from associations.

There have been a wide range of efforts to disseminate technology information to law enforcement practitioners. The OJP's efforts alone include the resources of *CrimeSolutions.gov*, *JUSTNET.org* (NLECTC's portal), NIJ's web site (*NIJ.gov*), and the National Criminal Justice Reference Service portal (*NCJRS.gov*). However, this theme—along with other needs that call

for technologies or information that already exists—reflects needs that have been unmet to date, even given existing efforts.

Recommendations. The number and extent of criminal justice technology information dissemination efforts already under way call for strategic coordination rather than entirely new efforts. One might make an exception for the repeatedly asked-for repository of tools, guidance information, and technology and technology expertise–related links, but this can be framed as an issue of where to host the repository and how to design it by adapting existing resources (*JUSTNET*, etc.) rather than create something entirely new.

We recommend designating a federal (or federally sponsored) coordinator for technology-related outreach to work with the various offices already involved to develop and monitor a dissemination strategy capturing who will do what, for whom, and when, along with dissemination metrics to assist practitioners in learning about and using key technologies and associated methods. The “strategy” is meant to be a living schedule showing what dissemination activities are going on, not a one-time paper document that is unlikely to have a real-world impact.

An especially important part of the dissemination strategy will be partnering with associations, including practitioner, researcher, and developer associations. As noted, agency representatives noted that they get much of their information on technologies from associations, so partnering appears to be the most promising path to get more information to, and more repository visits from, the field. Partnering with researcher and developer associations appears to be the most promising pathway to gets needs and operational considerations captured from practitioners out to researchers and developers and to provide pointers to key development resources (such as interoperability resources—see below).

Theme 2: Need to Improve the Dissemination of Best Practices Related to Technology Management and Process Improvement

Contributing needs:

- Improve the alignment of strategic requirements with technology.
- Conduct a geospatial capability survey.
- Employ POP guides for change management.
- Make a greater R&D investment in process improvement.
- Improve program management of technology resources in general.
- Improve the retention of legacy knowledge.
- Better address exponential growth in technology and data.

In addition to calls for particular technical knowledge, there is a strong desire for assistance in what might be referred to as guidance on technology management and business process improvement—help with change management, with requirement and acquisition processes, and with managing technology and complex operations in general.

Recommendations. We see much of this as being a coordination effort building on resources already in existence or in process. We envision a major part of the dissemination strategy being identifying, refining, and distributing resources broadly concerning technology management and process improvement.

Other Needs Related to Improving the Community’s Knowledge of Technology

Beyond these two principal themes, a number of top needs directly related to improving the law enforcement community’s knowledge of technology, by, for example, calling for training

packages or model policies and procedures that would be expected to be offered in the much-called-for repository. Examples include

- proactive/preventive measures for incident/stress management
- models, resources, and examples for health programs
- training on social media tools and capabilities
- training leaders for resiliency
- dealing with deficiency in skill sets tool
- standard policies, procedures, and assessments for video surveillance
- privacy and civil rights policies for sensor systems
- guidance and support for cybersecurity
- lower technology life-cycle costs in general (e.g., acquisition guidance)
- mechanisms to address major budget cuts
- improved budget situations in general (e.g., guidance on how to improve budgeting and make cases for additional funding)
- checklists for handling critical, infrequent crimes
- better law enforcement training for multiagency/unified command response during events
- reference MOUs for multiagency response.

Keynote B: Improving the Sharing and Use of Law Enforcement–Related Information

This keynote covers a range of needs calling for the improved sharing, display, and use of law enforcement information, principally of data collected in law enforcement RMSs, CAD systems, and record repositories at the state, regional, and federal levels. In addition to the two principal themes related below, several other themes had strong information-sharing elements, including improving communications with the public via social media and improving security, privacy, and civil rights policies for various technologies, notably including information exchange.

Theme 3: Need to Improve the Sharing of Law Enforcement–Relevant Information

Contributing needs:

- Further develop and enforce RMS/CAD and other key criminal justice data standards.
- Conduct a nonpolicing data study.
- Improve knowledge management systems (RMS, data exchange).
- Improve communication infrastructure in general.
- Encourage federal leadership in improving interoperability.
- Study 911 and 311 geospatial capabilities.
- Study regional and interagency information-sharing.
- Standardize definitions (for criminal justice performance measures and information exchange).
- Tackle cross-agency radio communication interoperability.
- Extend systems that support database queries and reporting in the field.
- Develop systems that notify officers when inmates have been released (or other major event involving persons under supervision occurs).

- Create a routing system for approvals and paperwork.
- Make a greater investment in R&D for IT standards.

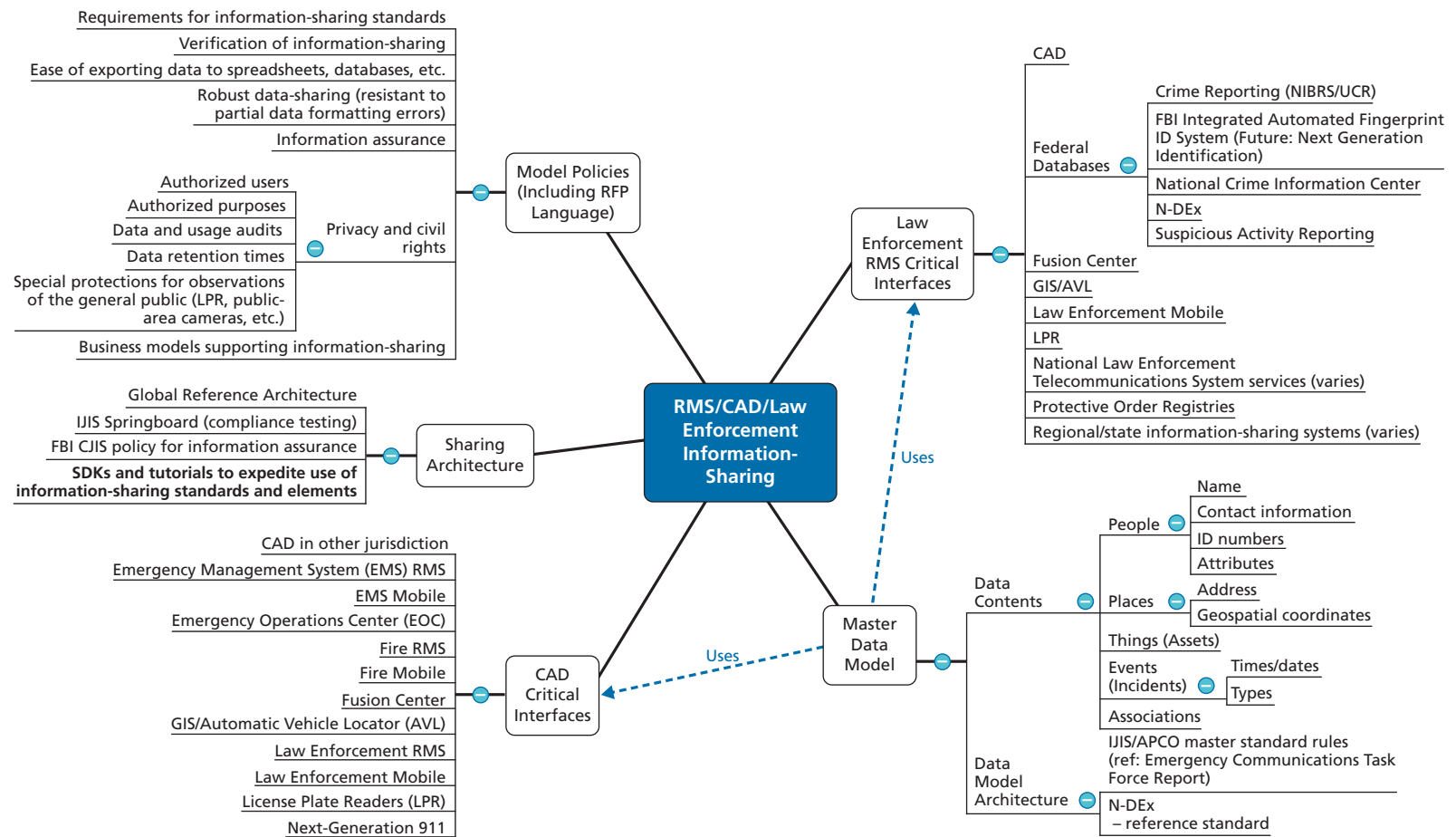
The second-strongest theme from across the needs was to improve the sharing of law enforcement–related information across multiple agencies and systems. There were needs to improve the sharing of law enforcement–related data from and across RMS/CAD and other key criminal justice databases, out to users at all echelons, from tactical users in the field through regional commanders and staff. The theme includes calls for interoperability standards, improvements to the systems bringing about data-sharing, and performance metrics. In addition, the theme includes calls to study the use of particular types of data—nonpolicing data and geospatial data, specifically. The theme also includes calls for improvements to communication infrastructure carrying the information—technically outside the center’s IT purview but well worth noting.

A great deal of work has been done to improve information-sharing. The center is aware of national-level efforts to improve data-sharing from the National Information Exchange Model, the Department of Justice’s Global Justice Information Sharing Initiative, the FBI (especially the National Data Exchange), the IJIS Institute, Association of Public Safety Communications Officials, and IACP, among others.

The center itself has conducted a study on key law enforcement information-sharing systems and mechanisms (Winkelman and Hollywood, unpublished) and has seen and discussed this topic many times across its interviews, site visits, and conferences. We have a number of key observations.

First, this is a difficult problem, whether considered technically (there is an enormous amount to be done), organizationally (governance and policy challenges), or commercially (challenges in business models of who pays for it while making it affordable). Figure 3.1 is a mind map summarizing key R&D elements still needed to facilitate RMS, CAD, and other key law enforcement information-sharing. (Some of these elements are in progress, but they are all far from complete.) The elements include the technical—creating a master data model to be the baseline for tailored system interfaces involving links from RMS and CAD to other key systems, along with other data architecture elements. They also include the educational—SDKs and tutorial material to help developers and administrators use all of the information-sharing resources. The elements also include standardized policies, procedures, and acquisition language to support the organizational and commercial aspects of information-sharing. These need to deal with numerous legal complexities, depending on the agencies (and levels of agencies involved)—for example, specific requirements to retrieve different types of data from the FBI, other federal agencies, or state governments. Winkelman and Hollywood (unpublished) review the needed elements in detail; the figure is intended just as a top-level guide to what would need to be done here, but there is no denying the complexity and magnitude of what is shown. The top branches of Figure 3.1 include creating and disseminating a range of model policies; creating and disseminating SDKs and tutorials to support developing code for information-sharing; greatly expanding testing and certification initiatives; creating, maintaining, disseminating, and enforcing a master data model to be tailored across a range of critical data interfaces; providing policies, instruction, and tools for cybersecurity; and managing all of these efforts across a wide range of existing information-sharing programs and initiatives. The challenge is compounded by the fact that Figure 3.1 shows only elements that have been labeled as “critical” or “top priority” from various sources. That said, a great deal of progress

Figure 3.1
Needed R&D Elements for Law Enforcement Information Interoperability



has been made to make information-sharing *possible* for committed agencies and organizations, although it is far from the default.

Second, interoperability development efforts do have limited coverage and have inconsistencies among them—data-sharing standards with inconsistent treatment of similar data elements, for example, or standards that allow too much variation in how to represent data elements. The problems are compounded by having literally dozens of organizations and efforts involved in information-sharing, with limited coordination between them.

Finally, it is particularly difficult for new agencies seeking interoperability and developers seeking to provide it to learn about using all the available tools and resources.

Recommendations. Again, the number and extent of criminal justice technology information-dissemination efforts already under way call for strategic coordination rather than entirely new efforts. A federally sponsored coordination role is needed to

- maintain a master list (which is probably better visualized as a taxonomy, such as that in Figure 3.1) of outstanding needs and corresponding tasks to be done to support law enforcement information-sharing
- capture which information-sharing projects are addressing the required tasks, work with the sponsoring organizations to deconflict efforts if necessary, and advocate for addressing key needs and tasks that are not being addressed
- monitor the information-sharing tasks, updating their status
- capture and disseminate all of the above in an “information-sharing strategic plan”—again, the plan would comprise dynamically managed taxonomies, status descriptions, and schedules rather than be a one-time paper document.

Dissemination efforts for the resulting information-sharing resources and tools to use them (notably the SDKs and tutorials) should be conducted through the coordination function and repository functions discussed under Theme 1 above. (The repository called for under Theme 1 would probably point to resources stored on existing technical platforms, not store them itself.)

As with technology information dissemination, partnering with associations will be key—especially given that associations are active in developing a great deal of the material and resources that will contribute to information interoperability.

Theme 4: Need to Improve the Display and Use of Law Enforcement Information

Contributing needs:

- Develop standard common operational picture systems.
- Make more R&D investment in common operational picture systems.
- Assess how to use new IT/maps/displays in COMPSTAT.
- Use IT for personnel deployment tracking and management.
- Provide in-field tactical analysis support.

Directly related to the issue of sharing law enforcement information is the challenge of displaying and using it once received. This challenge gives rise to calls for tools that display tailored *situational awareness* information to law enforcement users at all levels, from the field to commanders. These sorts of displays are often referred to as common operational pictures or dashboards—they typically provide some sort of map overlaid with key information that

users need to support their jobs. The “map” is typically a geospatial map, but in law enforcement, “maps” can include such displays as social networks, timelines, and graphs and charts analyzing crime phenomena as well, depending on what is needed. These tools need to support common operational picture–like displays and drill-down capabilities, tailored to users’ current needs to help them make better decisions.

The center is seeing progress in this area. We have seen the emergence of dashboards from vendors and individual departments that display information; center researchers have also talked with several providers of commercial dashboards (that monitor the status of commercial processes, such as order flows and supply chains) interested in entering the area. Several NIJ-funded mobile application projects are dashboard-like, providing maps to officers at different levels overlaid with event data and other information of interest.

It should be noted that crime predictions (from predictive policing tools) are seen here as just one element in providing a larger common operational picture to users. The center did not receive any Tier 1 needs just for novel and more accurate predictive analytics algorithms.

Recommendations. This is an area needing additional RDT&E. Although the idea of providing common operational picture/dashboard displays is well recognized, much work needs to be done to understand what sorts of displays and display features might be most useful to practitioners in different roles. The different roles—and corresponding types of displays—would include agency command (discussions have been about replacements/evolutions to COMPSTAT, for example), field-level operations, and departmental planners and schedulers.

Theme 5: Need to Improve Mechanisms to Communicate with the Public

Contributing needs:

- Make social media easy for police departments to use.
- Study criminal justice–to–public communications.
- Train on social media tools and capabilities.
- Develop methods and tools to improve agencies’ communications with the public.

This theme includes police use of social media communications, as well as looking more broadly at how police might improve their communications with the public. The center is seeing increasing agency interest in, and use of, social media; presentations on it at practitioner conferences have tended to be extremely well attended. IACP maintains a Center for Social Media web portal. We have observed less coverage of public–law enforcement communications in general.

Recommendations. This is an area needing additional RDT&E, to be focused more on assessing techniques to improve public–agency communications in general. Social media is of high interest, but here the recommendation is more to monitor and support ongoing efforts to disseminate social media guides, as part of the coordination effort recommended under Theme 1. (Note, for example, that the IACP has a Center for Social Media.)

Keynote C: Needs for Other Technology RDT&E

This keynote covers a range of themes calling for new technology RDT&E. Of interest is that many of the needs have to do with calls for nonmateriel deliverables (research on new processes

and techniques, guidance and training on new processes and techniques) rather than materiel technology deliverables (new tools or products).

Theme 6: Need to Improve Health Systems

Contributing needs:

- Develop proactive/preventive measures for incident/stress management.
- Quantify how a wellness program improves quality of operations.
- Make greater R&D investment in officer health.
- Develop models, resources, and examples for health programs.
- Employ a scheduling and staffing tool to improve quality of life.
- Create an early-warning system for officer emotional state.

This theme identifies an overarching need to improve methods and systems monitoring and supporting officers' health, especially mental health. The theme includes early-warning monitoring systems, improvements to incident and stress management measures, and scheduling and staffing approaches that improve officers' quality of life. (Theme 10, on training, also includes a relevant need relating to training leaders for resiliency.)

The center has seen substantial interest from practitioners in this area but is aware of few systems to date. The market survey and supply and demand analysis found no NIJ awards and only one commercial system during its review period.

Recommendations. This is an area needing additional RDT&E. We emphasize that R&D in this area needs to address mental health (note the stress management and emotional state–related needs above) as well as physical health.

Theme 7: Need to Improve Privacy, Security, and Civil Rights Policies

Contributing needs:

- Develop standard policies, procedures, and assessments for video surveillance.
- Develop privacy and civil rights policies for sensor systems.
- Provide guidance and support for cybersecurity.

Law enforcement's use of technology has been challenged by civil and privacy rights concerns and objections and directly attacked by cybersecurity threats. There is an overarching need for greater development of standard policies and procedures related to civil rights, privacy, and security.

For the civil rights and privacy areas, a major recent conference theme has been that law enforcement's use of surveillance technologies is facing a growing raft of legal challenges. This is especially true of systems that can generate large numbers of observations of the general public, with examples mentioned in recent conferences including LPR systems and surveillance cameras in public areas (especially combined with automatic facial recognition technology). Key drivers for the challenges have been what have been perceived as inadequate privacy and civil rights policies (e.g., surveillance data collected as widely as possible for indefinite lengths of time for uncertain purposes other than that it might be useful in the future).

For the cybersecurity area, a major theme from the 2013 IACP conference was both that the cybersecurity threat is increasingly rapidly and that many departments lacked knowledge of what to do to protect their systems. Center researchers have observed that tutorials to explain to departments what needs to be done is lacking—most material is for those with

experience in defending computer networks (e.g., bulletins on specific cyberthreats). Standard policies and training for these areas are starting to be developed by the IACP and others; as an example, the IACP, with BJA support, is creating a Law Enforcement Cyber Center.

Recommendations. Given efforts starting to address these policy concerns, this area is probably one to be monitored, with existing efforts supported, rather than starting new efforts. The federally sponsored coordinator for technology dissemination (see Theme 1) should assist with the dissemination of the model policies and policy language as they are completed.

Theme 8: Need to Improve the Affordability of Technology

Contributing themes:

- Strive for lower technology life-cycle costs in general.
- Develop mechanisms to address major budget cuts.
- Improve budget situations in general.

Especially given the recent recession and subsequent government budget cuts, there is a need to improve the affordability of technology, as measured by the total life-cycle costs of systems. There is also a broader need to help agencies identify ways to help address budget cuts and improve financial situations in general.

For IT affordability, the center has observed some migration toward shared services/cloud models and centrally funded IT portals. Examples include states or regions providing RMS services to a number of smaller agencies. There has also been an emergence of comparatively affordable RMS/CAD packages for smaller and disadvantaged agencies, with examples including systems both coded by agencies (or agency contractors) themselves and developed by commercial providers.

The center has frequently heard calls to sponsor the building of free systems, such as open-source RMS/CAD systems. Attempts to build and field such large-scale free tools have tended to be unsuccessful because of long-term sustainability issues—products either do not get out of R&D or go commercial, as funding usually lasts only long enough to develop the initial code.

Recommendations. Information about alternative, lower-cost business models and systems acquisition models should be a priority for coordinated dissemination, as under Theme 1. Developing practices to help address budget restrictions in general is an area for further RDT&E.

Theme 9: Need for More Research and Evaluation on Practices to Reduce Crime

Contributing needs:

- Examine alternatives to mass stops and arrests.
- Develop checklists for handling critical, infrequent crimes.
- Conduct R&E to reduce crime from repeat offenders.
- Conduct R&E to reduce high-volume crime.

Directly related to sharing and displaying information are needs for requesting assistance on what to do when given information about what, when, and where criminal activity is likely to be concentrated, and by whom. This theme concerns further R&E on criminal justice practices that preempt crime, especially given budget cuts and declines in prison populations. Specific needs in this category include R&E on alternatives to mass stops and arrests for low-

level crimes, given legal claims that such tactics violate civil rights (a keynote theme at the 2013 IACP Conference). They also include R&E on ways to reduce crime from high-repeat offenders and reduce high-volume types of crime; a near-Tier 1 need calls for R&E on ways to reduce crime in places that see high volumes of crimes.

Recommendations. Much of NIJ’s Office of Research and Evaluation policing portfolio is relevant for helping to address these needs, so a large part of addressing this theme falls under the category of federally sponsored dissemination, as discussed under Theme 1, above.

That said, it does appear that some additional research may be warranted, specifically on the alternatives to mass stop-and-frisk and arrests (a fairly common tactic in predicted crime hot spots) and more broadly addressing high-frequency crime types, repeat offenders, and locations. To date, programs and practices demonstrated to be effective have tended to focus primarily on allocating more resources to projected “hot spots” and “hot people”—for example, *CrimeSolutions.gov*’s declaration of the practice of hot-spot policing to be effective, as well as programs that assign high-risk probationers to intensive supervision. Less attention has been given to what, specifically, should be done with those resources.

Theme 10: Improved Major Event Response Technology

Contributing needs:

- Use deployable, wearable tracking systems (GPS) specifically for event response.
- Employ public information channels to warn the public away from areas during events.
- Give better law enforcement training for multiagency/unified command response during events.
- Reference MOUs for multiagency response.

Practitioners have expressed a good bit of interest in IT for responding to major events and disasters. This theme includes calls for tracking systems for responders during major events, improved unified command training for large-scale responses, and reducing the cost of homeland security supplies in general.

Recommendations. Federal efforts in this area are supported predominantly by DHS; we envision partnering with DHS to report these specific needs and determine how they might be addressed.

Theme 11: Need for Improved Deployable Sensor Technologies

Contributing needs:

- Employ light wearable cameras.
- Use deployable, near-real-time field biometrics.
- Use deployable electronic evidence collection.
- Employ dispatchable/deployable CCTV systems.

Finally, this theme calls for wider development and dissemination of a variety of sensor systems. The theme includes a range of sensors, including calls for very lightweight body-worn cameras; deployable biometric devices with a range of biometric sensors and connectivity needed to positively identify someone within minutes; a device that can extract photos, texts, and other electronic evidence from witnesses’ cell phones within minutes; and portable CCTV systems that could be dispatched and set up as needed, in response to, for example, a predicted temporary hot spot.

Recommendations. All the basic technologies for these tools exist to varying degrees; the issues appear to include awareness, cost, and the sophistication of current tools. The light wearable cameras and deployable CCTV systems appear likely to be straightforward adaptations and disseminations of existing technologies. The other two appear to be better candidates for RDT&E. The near-real-time biometric device would require more complicated advancements on what have been predominantly military systems, in addition to a good deal of engineering and policy work to set up the identification biometric databases, connections, and legally valid rules for using the devices. The electronic evidence-collection tool would face challenges in capturing and maintaining evidence that would be admissible in court (among other issues, the device would have to guarantee that the evidence had not been altered in any way).

Next Steps in Needs Assessment

This report reflects the conclusion of the NLECTC Information and Geospatial Technology Center's needs assessment and strategic planning activities for NIJ. Criminal justice technology needs assessment for NIJ is being carried forward by a dedicated technology needs activity consortium, headed by RAND, in partnership with the University of Denver, RTI International, and the Police Executive Research Forum. The current schedule for the needs assessment activity is to perform about one wide-ranging advisory panel per year, including both an in-person and an online component, for each of the three major communities of practice (law enforcement, courts, and corrections). The LEAP was held in 2013–2014; the Corrections Advisory Panel was held in 2014, and the Courts Advisory Panel will be held in 2015. A number of panels and needs assessments will also be examining particular topics.

In terms of next steps, reflecting lessons learned over the course of the center's activities, the central takeaway is to treat the set of law enforcement needs (and in the future, criminal justice needs) as a living data set that evolves over time, rather than as a one-time document. It will also be important to actively disseminate the needs information throughout the law enforcement community of practice (again under Theme 2) and engage interested parties about it. This is especially important, since the bulk of the S&T work to address these needs will come from outside NIJ.

In terms of specific advisory panels that might be convened on law enforcement technology needs, we suggest the following topics:

- needs specifically related to improving the health of law enforcement personnel
- needs specifically related to reducing casualties in the line of duty
- needs specifically related to solving crimes
- needs specifically related to physical equipment used by law enforcement (non-IT needs).

The first three refer to law enforcement objectives that saw comparatively few priority needs in the LEAP (see Figure 2.3). The last relates strictly to the fact that the LEAP focused on IT needs, broadly defined, and it would be of value to explicitly examine law enforcement needs outside IT.

Funding agencies and developers may want to consider specific investment options to address subsets of the needs in this report. That would lead to creating and optimizing portfolios of potential investments. As mentioned, RAND has a body of research on S&T portfolio

optimization, which is available for download; notable examples include *Toward Affordable Systems I, II, and III* (Chow, Silbergliitt, and Hiromoto, 2009; Chow et al., 2011; and Chow et al., 2012, respectively).

Conclusion: A Road Map for Law Enforcement Information Technology Science and Technology Efforts

Our road map for law enforcement IT efforts is intended to integrate action items to address the keynotes, themes, and top needs identified above and actively maintain needs assessment. The road map has four main parts, corresponding to the three major thematic areas identified above and a list of next steps in technology needs assessment.

Part 1 concerns the dissemination of technologies and technology information, addressing the most important keynote emerging from our needs assessment work. Table 3.2 captures the principal tasks required in this area, including coordination of dissemination, maintaining a tool and method repository, and providing guidance to agencies on using and managing technology. For the latter task, the table identifies specific categories of guidance materials that need to be stored in the repository and disseminated to meet key needs identified in this report. We envision all dissemination efforts from the other road map elements coordinated through this element (including being stored in, or pointed to, the repository).

Part 2 concerns coordinating and aligning the ongoing array of information-sharing development efforts, to both address the range of elements defining what it will mean to be

Table 3.2
Law Enforcement Information Technology Road Map: Dissemination

Topic	Subtopic (if applicable)	Action
Coordination of dissemination		Build and maintain partnerships with associations. Maintain a dissemination strategy that dynamically captures who is doing what, for whom, on what schedule, and with what measures.
Tool and method repository		Provide access to tools and educational materials about technologies and methods. Provide pointers to providers and experts who can provide assistance.
Providing guidance to agencies on using and managing technology (to go in repository, etc.)	Management and process improvement	General process improvement Change management Requirements and acquisition processes Lower-cost business models for IT (shared services, cloud, shared licensing, etc.) Technology program management
	Best practices for reducing crime	Hot-spot intervention approaches (including alternatives to mass stops and arrests) Recidivism reduction/deterrence Crime-specific reduction methods
	Practices for improving health	Processes to improve physical health Processes to improve mental health
	Information-sharing	See <i>Figure 3.1 for specific materials</i>
	Best practices for public-agency interactions	Via social media Other channels

“interoperable” in Figure 3.1 and avoid overlaps and conflicts. Coordination and alignment functions will need to include

- tracking and aligning information-sharing needs and ongoing development efforts
- coordinating deconfliction efforts
- advocating for addressing unmet information-sharing needs
- in general, maintaining partnerships with all the organizations involved in developing resources for information-sharing.

Part 3 concerns technology areas warranting additional RDT&E, as identified across the themes above. These include

- common operational pictures/dashboards
- monitoring and supporting health, including both physical health and mental health
- practices and tools to improve public-agency communications in general
- practices and tools to help address budget restrictions in general
- practices and tools to reduce crime, including
 - alternatives to mass stop-and-frisk/arrests
 - frequent offenders
 - high-volume crimes
 - frequent-crime places
- deployable multisensor biometric systems
- deployable electronic evidence collection.

Part 4 concerns ongoing needs assessment and maintenance of needs lists. Table 3.3 captures needs management functions and identifies the four recommended law enforcement advisory panels on specialized topics. As noted, the recommended panel topics reflect objectives that had proportionally few needs from the LEAP, including officer health, officer safety, and solving crimes. More broadly, we believe that it would be useful to have a focused panel looking specifically at non-IT needs for law enforcement, focusing on physical equipment used by law enforcement personnel.

Table 3.3
Law Enforcement Information Technology Road Map: Ongoing Needs Assessments

Topic	Action
Active needs management	Extend needs management to non-IT law enforcement technologies (see Figure 1.1), courts, and corrections. Track status of needs over time (e.g., any efforts to address needs). Disseminate needs (including via repository; see Table 3.2). Manage partnerships with practitioner and vendor associations.
Panels on focused topics	Provide physical equipment for law enforcement (non-IT). Support improvements to the health of law enforcement personnel. Support reductions in casualties in the line of duty. Support solving crimes.

Information Technology Capability Demand and Supply Analysis: Results of the Market Survey

As mentioned, the purpose of the demand and supply analysis was to identify technology areas that appear to have comparatively few systems and NIJ awards with respect to the number of needs. These areas reflect potential gaps in R&D to date; we treat these gaps as needs for further research in our analysis.

The first section, below, presents the IT and analytics capabilities supporting the demand and supply analysis. The second section presents the analysis methodology and results.

IT and Analytics Capabilities for the Demand and Supply Analysis

To define different technologies for this assessment, in 2011 the center developed a list of broad IT and analytics capabilities and subcapabilities. As mentioned, this list was extended and superseded by a new comprehensive technology taxonomy framework developed under RAND's Priority Criminal Justice Needs Initiative for NIJ/NLECTC. The list of capabilities and subcapabilities follows.

Infrastructure. This capability refers to underlying systems that are necessary for the overall functioning of criminal justice organizations. Infrastructure includes hardware, software, and networking systems that gather, store, share, and disseminate information that is critical to the daily operations of a criminal justice agency. Infrastructure also includes general-purpose systems and tools typically found in an agency and can be used or built on for specific purposes or tasks. Subcapabilities include

- records management, notably RMSs
- handling calls for service, notably CAD systems
- information-sharing tools, generally systems and networks designed to share law enforcement data across multiple echelons and agencies
- information-sharing standards for sharing law enforcement data across differing systems
- generic IT support, including productivity software and collaboration portals.

Sensors. This capability refers to the collection of information from sensors, such as video or photographic cameras, to monitor or identify materials, activities, persons, or information of interest.¹ These systems can either help in specific policing missions or further the overall goal of public safety. Subcapabilities include

¹ The center considers sensors in their role as information-generating tools; we did not assess sensors' technical performance in such areas as resolution, range, or error rates.

- incident awareness in public venues, notably cameras, photo, and video analytics that help identify and respond to public safety incidents
- aerial surveillance, including both airborne and satellite systems
- detection of contraband, including sensors to detect weapons, drugs, and illicit cell phones
- automated reading and processing of license plates.

IT for tactical policing. This capability refers to the use of information technologies by the police that will further their effectiveness in the field. It includes gathering information from the field to effectively respond to immediate situations, as well as information relevant for investigations later on. It provides mission-critical information to field-level officers and enabling communications for individuals in the field. It records data in the field for further processing and record-keeping by headquarters. Subcapabilities include

- monitoring the location and status of individuals and equipment, such as AVLs
- providing information to officers in the field, such as remotely accessing databases to get personal history, vehicle history, and address history information
- recording information from the field, such as in-car cameras, body-worn cameras, and field reporting software.

IT for operational policing. This capability refers to IT supporting agency operations at the command and headquarters levels. Subcapabilities include

- providing a common operational picture to supervising and monitoring officials that presents context-appropriate information on crime events (and other incidents) and agency status to support command decisionmaking
- supporting agency operations personnel in disseminating timely warning and information to the public.

Predictive analysis. This capability refers to analytic tools and technologies used by crime analysts to yield predictive recommendations ranging from which times and spaces are most at risk of a crime, to who is most at risk of being a victim or perpetrator, to who most likely committed a series of crimes. These tools typically analyze criminal activity patterns.

Support for criminal investigations. This capability deals with gathering, evaluating, and testing evidence necessary for establishing a suspect's guilt or innocence during the course of a criminal investigation. Subcapabilities include

- tools and processes that collect, record, and manage DNA forensics
- tools and processes to examine a single type of data such as a video recording, interviews of suspects, fingerprints, or mugshots
- multiple or "all-source" analysis tools that can combine and analyze investigative data from multiple databases.

Safety and health. This capability addresses personnel safety and health. It is limited to IT systems and excludes such equipment as body armor and nonlethal weapons. Subcapabilities include

- systems to monitor officers' health, both physical (such as medical telemetry devices) and mental (such as early-warning systems)
- systems to monitor and enhance officers' safety, such as in-car cameras monitoring driving.

Training. This capability refers to technological tools that train criminal justice officers with developing new skills or improving old skills or providing officers with new knowledge or continuing education. Subcapabilities include

- software and online training
- simulator training using physical devices, such as those for weapons and driving training.

Process improvement. Finally, this capability refers to IT used to support process improvement. Process improvement is defined, in turn, as an agency adapting how it carries out one or more activities to realize gains in efficiency (i.e., accomplishing tasks more quickly or with less manpower) or effectiveness (i.e., achieving better performance according to a metric, such as the number of arrests or cases closed). Process improvement also includes modifications to better accommodate external changes, such as budget reductions or changes made to take advantage of new technologies. The latter includes tools designed to understand how current processes within criminal justice agencies are performing and tools that will assist these agencies to either modify or completely change their ways of operating altogether.

Supply and Demand Analysis

Once this set of capabilities was developed, the center performed a series of searches to identify both current systems and recent NIJ awards supporting the capabilities and subcapabilities listed above.

For systems, the center attempted to cast as wide a net as possible by reviewing reports and equipment listings in such law enforcement websites as *JustNet*, *Tech Beat*, *PoliceOne.com*, and others pertaining to law enforcement. The center also visited websites published by practitioner associations that list technology providers and their systems. These included pertinent lists of technology providers, systems, and exhibitors at major conferences, such as the annual IACP and IACA conferences. Also examined were many surveys and equipment listings on specific classes of systems, such as CAD software and RMS. From all the above leads, the team identified the specific name and description of each system and its manufacturer. It was also typical that additional IT law enforcement systems were identified from manufacturers' promotional materials.

The result is a list of 664 systems, which is part of the database available as an electronic appendix to this report. For each system, we list the system name, provider, source website, a brief description (quoted directly from the source website), and the system's primary capability and subcapability as defined in the section above.

For NIJ awards, the center reviewed award summaries captured in online OJP databases from 2006 to 2010, identifying a candidate list of awards that both related to law enforcement IT and concerned law enforcement; the list was then reviewed and approved by NIJ. The result is a list of 64 awards.

There are significant limitations with both lists of systems and awards. The system list is a static snapshot based on a review from mid to late 2011; more broadly, while COE researchers reviewed a very broad range of law enforcement technology websites to identify systems, we almost certainly missed a good number of relevant ones. The assignments of systems to capabilities are based strictly on the providers' descriptions of the systems. Similarly, for NIJ awards, the list does not take into account awards made after 2010. Further, the assignments of systems to capabilities are based strictly on award titles and some additional abstract information, as NIJ did not have detailed information about each award readily available. Finally, we emphasize that including a system or award in the database is in no way intended to constitute an endorsement and that not including a system is in no way intended to constitute a disapproval; the latter merely reflects that the system did not turn up in our search. The lists are in no way intended to be complete—instead, they are merely intended to reflect a reasonable reflection of what systems appear to be readily available (as of 2011, when the system review was performed) and what research topics NIJ has tended to fund.

We then performed a simple numerical comparison of the distributions of these needs by IT capabilities to the distributions of identified systems and awards. We also experimented with sensitivity analyses to ensure that the major findings were robust to limited changes in the awards, systems, and needs, given that all three are likely to change over time.

Table A.1 compares the total percentages of technology needs with the percentages of the current systems and NIJ awards that the center team found for each technology subcapability category. The largest “average gaps”—defined as the average of the percentage point differences between systems and needs and NIJ awards and needs—are highlighted in pink. These reflect cases in which, based strictly on raw percentage counts, the “demand” (quantity of needs) outstrips the “supply” of both current systems and NIJ research that might contribute to future systems. As shown, the biggest average gaps, highlighted in red, were for

- Developing tools (systems and material) to help law enforcement agencies improve their operational processes, covering a wide range of law enforcement areas. This was by far the biggest gap, of over 18 percentage points on average. (The other three largest gaps were between 4 and 5 percentage points.)
- Providing common standards for information-sharing. Here, standards are broadly defined, including not just traditional information-sharing standards but also information-sharing policies, including privacy, civil rights, and security.
- Supporting the provision of common operational pictures for law enforcement.
- Providing systems and processes to monitor officer health, including both physical health and mental health.

There were two additional gaps over 2 percentage points, shown in tan: providing tools to examine data from a single source and assisting dissemination of warnings to the public.

Table A.1
Capabilities and Numerical Gap Analysis

Capability Name	% Needs	% Systems	% Awards	% Systems – % Needs	% Awards – % Needs	Average Gap
Infrastructure						
Records management	0.0	15.2	1.6	15.2	1.6	8.4
Calls for service	0.0	18.7	0.0	18.7	0.0	9.3
Information-sharing	8.0	12.2	26.6	4.2	18.5	11.4
Common standards	5.8	1.7	1.6	-4.2	-4.3	-4.2
Generic tools	4.4	3.2	3.1	-1.2	-1.3	-1.2
Sensors						
Incident awareness in public venues	2.9	3.0	1.6	0.1	-1.4	-0.6
Aerial surveillance	0.0	0.3	0.0	0.3	0.0	0.2
Detection of contraband	0.0	0.3	0.0	0.3	0.0	0.2
Automated reading of license plates	2.9	1.5	3.1	-1.4	0.2	-0.6
IT for tactical policing						
Monitoring the location and status of individuals and equipment	2.2	2.9	4.7	0.7	2.5	1.6
Providing information to officers in the field	6.6	13.1	14.1	6.5	7.5	7.0
Recording information in the field	2.9	5.4	4.7	2.5	1.8	2.1
IT for operational policing						
Provide a common operational picture	5.8	1.7	0.0	-4.2	-5.8	-5.0
Dissemination of warning to the public	5.1	2.3	3.1	-2.9	-2.0	-2.4
Tools for predictive analysis						
Crime and other predictive analyses	12.4	4.2	25.0	-8.2	12.6	2.2
IT for criminal investigation						
DNA and forensics data management	0.0	0.3	0.0	0.3	0.0	0.2
Tools and processes to examine data from a single source	3.6	1.5	0.0	-2.1	-3.6	-2.9
Tools and processes to examine data from multiple sources	1.5	3.2	0.0	1.7	-1.5	0.1
IT for officer safety and health						
Systems and processes to monitor officer health	4.4	0.3	0.0	-4.1	-4.4	-4.2
Systems and processes to monitor officer safety	0.0	0.0	0.0	0.0	0.0	0.0
Tools for training						
Virtual training	4.4	2.9	4.7	-1.5	0.3	-0.6
Training with physical simulator	2.2	1.4	0.0	-0.8	-2.2	-1.5
Training by instructors	2.9	3.8	0.0	0.8	-2.9	-1.0
Tools for process improvement						
Process improvement	21.9	1.2	6.3	-20.7	-15.6	-18.2

In terms of sensitivity analysis, a one-unit change in the number of needs, systems, or awards would have the following impacts:

- *Needs:* An additional need would increase the average gap by 0.73 percentage points ($1/137$ needs assigned to a law enforcement IT capability specified in the first section of this appendix).
- *Systems:* An additional system would decrease the average gap by 0.08 percentage points ($0.5 \times 1/664$ systems; the 0.5 comes from the fact that needs-systems gaps are one-half the average gap).
- *Awards:* An additional award would decrease the average gap by 0.78 percentage points ($0.5 \times 1/68$ awards; the 0.5 comes from the fact that needs-awards gaps are one-half the average gap).

Defining a gap as at least a two-point average gap, all of the top gaps (in pink) are robust to a single change in the number of assigned needs, systems, or awards; of the other two, only the gap for examining data from a single source is robust. The 1.5 percentage point deficit for training with physical simulators is the only other gap that could be created by a one-unit change.

As a result of this analysis, we recognize the needs for additional research and investment in the four capability areas with the largest gaps, plus a need for tools for examining single-source data (as that gap was robust, as well).

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This study reports on strategic planning activities supporting the National Institute of Justice (NIJ) in the area of information technology, collecting and analyzing data on law enforcement needs and offering potential solutions through technology assessment studies, extensive outreach and liaison activities, and subject matter expert panels. Strategic planning will help NIJ make the best investments to leverage its limited funds and help the range of technology developers supporting law enforcement better understand the law enforcement community's needs and priorities. By looking across the top-ranking needs, the authors identified 11 crosscutting themes in total. These themes are further grouped into three overarching keynotes—a broad need to improve the law enforcement community's knowledge of technology and practices, a broad need to improve the sharing and use of law enforcement–relevant information, and a broad need to conduct research, development, testing, and evaluation on a range of topics. The latter category includes research on both the “nonmateriel” side of technology, including policy and practices, and more traditional technical development.



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