Intelligent Transportation Systems
U.S. Department of Transportation

Next Generation 9-1-1 (NG9-1-1) System Initiative

Final Analysis of Cost, Value, and Risk
Executive Summary

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Findings

The U.S. Department of Transportation (USDOT) has taken a leadership position in assessing Next Generation 9-1-1 (NG9-1-1) technologies and the development of a framework for national deployment. USDOT understands that access to emergency services provided by 9-1-1 in today's world of evolving technology will ultimately occur within a broader array of interconnected networks comprehensively supporting emergency services for the public. USDOT established a research program, the NG9-1-1 Initiative, to—

- Promote the vision for the NG9-1-1 system
- Provide leadership, guidance, and resources to work with public and private 9-1-1 stakeholders
- Develop a path forward with the goal of migrating to a nationally interoperable[1] emergency services network using a phased approach.

The decision to deploy a new, Internet Protocol (IP)-based NG9-1-1 system is not a simple one and is affected by many complex factors related to institutional and service arrangements, equipment and infrastructure, and funding. This report examines the cost, value, and risk associated with migrating to an NG9-1-1 national framework. It estimates a potential range of lifecycle costs, identifies key values and risks inherent in each deployment scenario, and compares the risk-adjusted lifecycle costs and values. These efforts draw on the USDOT NG9-1-1 Initiative's previous work, which includes the NG9-1-1 *Concept of Operations, High Level Requirements, Detailed Requirements, Architecture Analysis, Final Transition Plan*, and the *NG9-1-1 Proof of Concept Design, Development, and Testing*.[2] This analysis is fully documented in the *Final Analysis of Cost, Value, and Risk*, submitted March 2009.

This analysis estimates the high level rough order magnitude (ROM) cost, value, and risk for potential NG9-1-1 deployment scenarios. It defines a basis for comparing the current 9-1-1 environment with potential NG9-1-1 deployment and operations scenarios. The results indicate that NG9-1-1 would deliver significantly more value (between 74 and 82 percent) than today's 9-1-1 environment. Over a 20-year lifecycle, NG9-1-1 would likely cost about the same as maintaining the status quo – estimates range from 87 to 129 percent of today's capital and operating expenses.

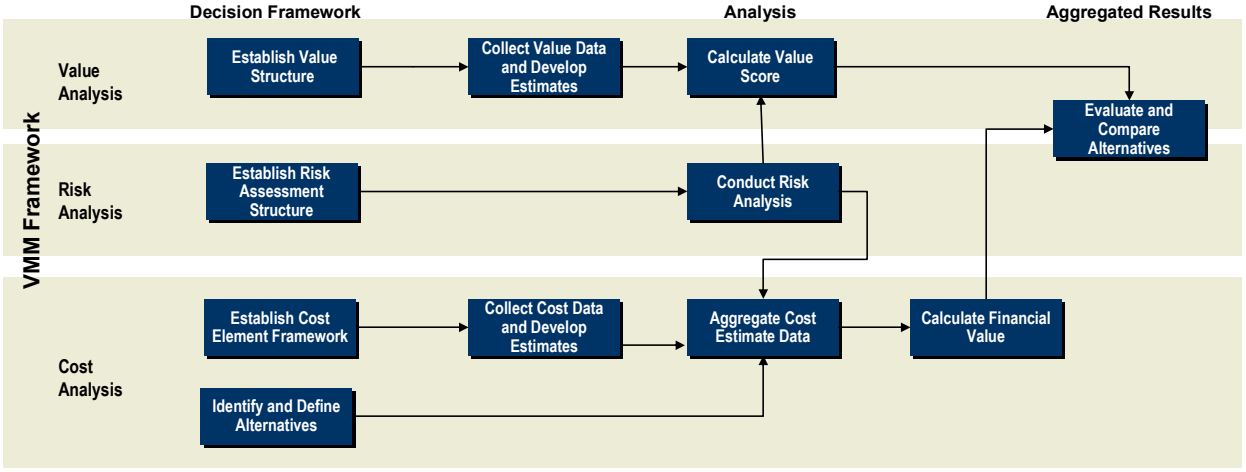
Methodology

The *Final Analysis of Value, Cost, and Risk* was prepared using the Value Measuring Methodology (VMM).[3] VMM provides a holistic and structured approach for examining a broader range of costs, benefits, and risks than those considered in a traditional cost-benefit analysis. VMM is based on a scalable and flexible approach for estimating and analyzing cost, value, and risk and evaluating the relationships among them, while allowing the calculation of non-financial value that might be unaccounted for in traditional financial metric calculations. It

[1] The emergency services internetwork will be "interoperable" in that the networks and systems that compose the NG9-1-1 architecture system of systems will have the ability to work together using standard formats and protocols.
[2] *USDOT NG9-1-1 System Initiative Concept of Operations*, March 2007; *USDOT NG9-1-1 System Initiative High Level Requirements*, July 2007; *USDOT NG9-1-1 System Initiative Architecture Analysis Report*, November 2007; *Final Detailed System Requirements*, October 2007; *USDOT NG9-1-1 System Initiative Transition Plan*, October 2008; are available at http://www.its.dot.gov/ng911/ng911_pubs.htm, (last accessed March 4, 2009).
[3] http://www.cio.gov/documents/ValueMeasuring_Highlights_Oct_2002.pdf, (last accessed date: March 4, 2009)

evaluates both quantitative and qualitative value and allows rigorous comparison of alternative scenarios. The objective of VMM is to capture the full range of cost and value provided by a particular scenario while considering project risks that might decrease value or increase cost. This approach complies with guidance from the Office of Management and Budget (OMB) and incorporates public and private sector analytical best practices. The VMM framework approach is presented in Exhibit ES-1.

Exhibit ES-1: VMM Framework Approach



The major steps of the analysis are summarized below:

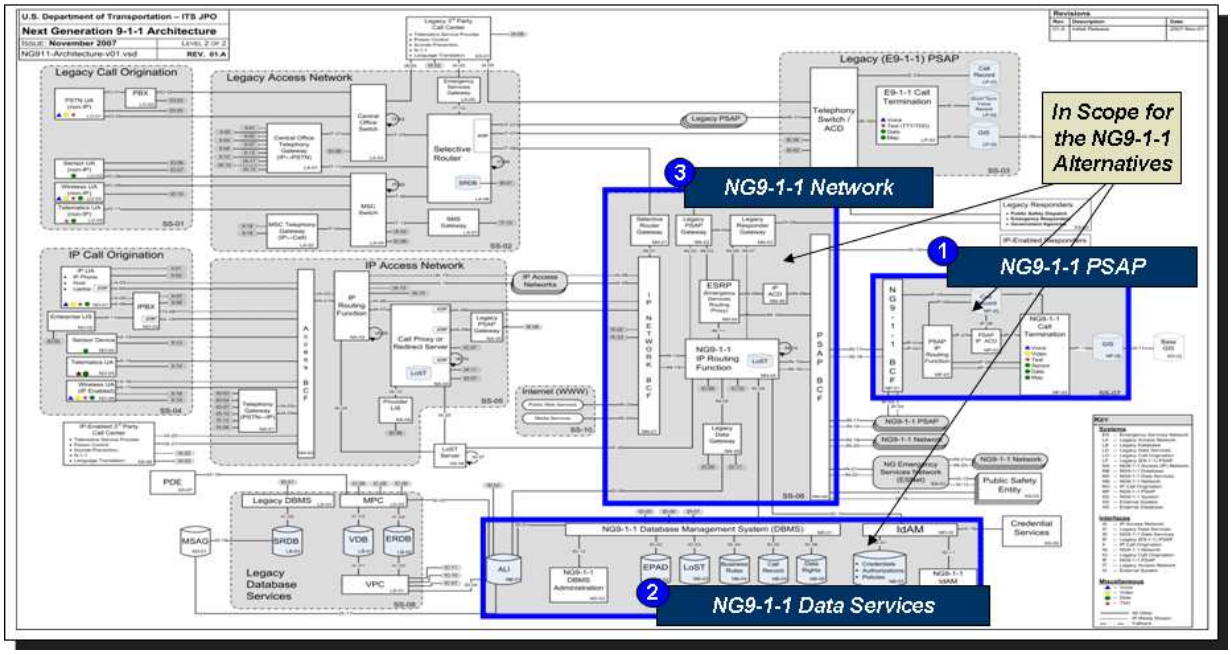
- **Value Analysis**—Non-financial value measures were identified and evaluated in a structured decision framework. For the non-financial analysis, the project team established weighted value measures for use in estimating the ability of each scenario to meet key criteria.
- **Cost Analysis**—A rough order of magnitude (ROM) cost estimate for each scenario was developed using a cost element structure (CES) that segmented costs into the different stages of a national deployment program lifecycle—planning, acquisition and implementation, and operations and maintenance. Operational lifecycle costs for each scenario were estimated in constant dollars, and inflated and discounted using OMB-approved factors. Discounted (Present Value) estimates were used for comparison purposes.
- **Risk Analysis**—Risks were identified based on input from stakeholder representation, subject matter experts (SME), and secondary research findings. The probabilities of occurrence and degree of impact of these risks were evaluated and assessed for cost and non-financial value. Risk impacts were then determined and applied to develop risk-adjusted costs and a risk-adjusted value score.

Key findings regarding the best alternative to pursue were based on integration of the cost, value, and risk analysis for each defined alternative scenario.

Scenario Descriptions

The *Architecture Analysis* provided the NG9-1-1 conceptual architecture that served as the underlying foundation for the development of several deployment and cost scenarios. The conceptual architecture is presented in Exhibit ES-2. The NG9-1-1 scenarios considered only the components highlighted in the exhibit.

Exhibit ES-2: NG9-1-1 Reference Architecture



The *Final Analysis of Value, Cost, and Risk* scenarios were rooted in and derived from the *Final Transition Plan*. The implementation environments and potential deployment approaches presented in the *Transition Plan* are the basis for the scenarios under study in this analysis. As discussed in the *Transition Plan*, it is expected that NG9-1-1 system implementation within the public sector will stem from one of the two general deployment scenarios described below, which largely reflect existing institutional and service delivery arrangements around the country:

- ***Coordinated, Intergovernmental Implementation.*** *System services generally reflect planned and coordinated deployments of 9-1-1 capabilities, facilitated by statewide 9-1-1 authorities, regional authorities, or informal mechanisms that enable a cooperative environment.*
- ***Independent, Unilateral Implementation.*** *System services generally reflect decentralized deployments of 9-1-1 capabilities by local jurisdictions through an environment featuring independent initiatives.*

However, as discussed in the *Transition Plan*, actual deployment across the country is likely to reflect a hybrid or combination of the coordinated, intergovernmental and independent unilateral implementation approaches, with various degrees of coordination and independence. Based on this discussion, two high-level NG9-1-1 deployment scenarios were identified for analysis—

Uniform and Hybrid—along with the Baseline (current environment) representing today's level of 9-1-1 technology:

- **Scenario 1—Baseline 9-1-1 (Current Environment):** A total cost scenario for current 9-1-1 operations given the current state of technology, people, and processes.
- **Scenario 2—NG9-1-1 Uniform Deployment:** A total cost scenario for a standardized national deployment of the NG9-1-1 system that correlates to a fully coordinated, intergovernmental implementation. The Uniform deployment scenario is assumed to occur over a 10-year period, with the majority of PSAP units deploying in years 5 and 6. For nationwide deployment, a standardized "Unit" was defined as a general population of 625,000 served by 32 call takers. Under the Uniform Deployment, a total of 508 Units are deployed with each being implemented over a 2-year time period. 50 Data Center/Networks Units are deployed to support the NG9-1-1 PSAPs. Each data center and network will support a population of 6,250,000 (or 10 PSAP units).
- **Scenario 3—NG9-1-1 Hybrid Deployment:** A total cost scenario for a variable-scaled national deployment of the Hybrid NG9-1-1 system that includes a combination of deployment approaches by different segments of the Nation, including a large-scale network and data center operations (serving 35 percent of the population), the uniform deployment approach discussed above (serving 60 percent of the population), and a small portion of deployments with an independent, unilateral implementation approach (serving 5 percent of the population).

The project team developed a structured notional plan for implementing NG9-1-1 on a national basis as a measure for estimating high-level costs, value, and risks for each of these defined alternative scenarios. The approach was designed to provide more insights from a national, holistic perspective. The approach was executed in two stages: development of a preliminary analysis (completed in February 2008) and completion of the final analysis (completed in December 2008).

Cost, Value, and Risk Analysis

The project team applied a structured approach to examine the alternative scenarios. Each component of the analysis—value, cost, and risk—was examined in detail to develop a complete understanding of each scenario and ultimately formulate the key findings documented in this report.

Cost Analysis

High-level cost range estimates were developed based on the NG9-1-1 *Concept of Operations, High Level Requirements,* and *Architecture Analysis* research studies, input collected from industry experts, project team input, industry benchmarks, and project team intellectual capital. Cost elements were segmented by planning, acquisition and implementation, and operations and maintenance for the defined scenarios.

The project team found that published estimates of aggregate national 9-1-1 operational costs range widely. To address this limitation, they estimated the upper and lower costs for the baseline 9-1-1 environment. The lower bound costs were calculated through a detailed build of baseline component costs—leveraging SME input and segmenting by population and current 9-1-1 system technology levels. To establish the upper end of the range, a conservative estimate was made of today's "cost per call" for PSAPs.

For the next generation alternatives, costs were also calculated through a detail build of components. The basis for the total NG9-1-1 costs was a notional rollout strategy for nationwide deployment of the system. The results of the cost analysis across all scenarios, presented in both nominal and discounted dollars, are summarized in the Exhibit ES-3.

Exhibit ES-3: 9-1-1 Lifecycle Cost Analysis (20-Year Lifecycle)

	9-1-1 Baseline*		NG9-1-1 Uniform*	NG9-1-1 Hybrid*
	Baseline Low	Baseline High	Total Cost	Total Cost
1.0 Planning	$-	$-	$0.2	$0.2
2.0 Acquisition and Implementation	$9.2	$13.2	$8.7	$9.1
3.0 Operations and Maintenance	$46.4	$65.8	$51.1	$49.1
Total Lifecycle Cost *(Nominal $B)*	**$55.7**	**$79.0**	**$60.0**	**$58.4**
Total Lifecycle Cost *(Discounted $B)*	**$34.9**	**$49.5**	**$37.5**	**$36.4**

** Base Year estimates are in 2007 Constant Dollars, Discount Rate: 5.10 percent, Inflation Rate: 2.24 percent (per Office of Management and Budget [OMB] Circular A-94, Appendix C)*

Each lifecycle cost aspect summarized in the table above represents a 20-year total cost estimate for the activity listed in the left-hand column. For example, for the Baseline 9-1-1 (Low Range) scenario, the total cost over 20 years for the Acquisition and Implementation of system upgrades is estimated to be $9.2 billion for national deployment. Operations and Maintenance costs over that same period are estimated at $46.4 billion, for a total cost of $55.7 billion. The analysis is based on the assumption that the labor used and the number of public service answering points (PSAP) remain consistent with those already in existence. Lifecycle costs indicate that the overall costs resulting from NG9-1-1 implementation, regardless of deployment strategy over the 20-year period, are comparable to those of today's 9-1-1 system. Specifically, the range of outcomes indicates that changing over to an NG9-1-1 deployment scenario could result in lifecycle cost savings of $20.6 billion, in the best case, to a lifecycle cost increase of $4.3 billion, in the worst.

Value Analysis

The VMM approach provided a means to calculate non-financial value/benefits that might be unaccounted for in traditional cost benefit or Return on Investment (ROI) calculations, allowing for a more complete comparison of alternatives. For NG9-1-1, there were important benefits that were either difficult or impossible to monetize because of the scope of the implementation. In some cases, additional investments were required to realize the full range of monetary benefits, which were considered outside this particular analysis, and thus, could not be completely monetized. The non-financial value component of this analysis examined the estimated ability of each scenario to deliver these critical non-financial benefits to the multiple stakeholders, as presented in Exhibit ES-4.

Exhibit ES-4: NG9-1-1 Key Stakeholder Groups

Stakeholder Segment	Definition
Direct Users	Any and all organizations that improve the safety of the public by being able to exchange information in emergencies, including the general public, special needs communities (e.g., hearing impaired), PSAP/9-1-1 Authority system management PSAP call takers, public safety dispatchers, first responders, and support responders
Government Agencies	Agencies responsible for establishing policy, funding, and overseeing the operation of PSAPs and emergency response services, including local, state, regional, and federal policy, regulatory, and funding agencies, emergency communications agencies, and federal emergency response agencies
Industry Associations and Standards Development Organizations (SDO)	Organizations responsible for overseeing development of key ubiquitous components of the NG9-1-1 system and for representing the interests and needs of affected stakeholder communities in that development, including professional and industry associations, SDOs, research and academia, private emergency response and recovery organizations, and citizen and special interest advocacy organizations
Service Providers	Entities responsible for functional services essential to the operation of next generation systems and the access to those systems by the public, emergency communications personnel, and responders. Also entities that represent specific public communities or consumer groups responsible for providing access to emergency services and/or data. These groups include "traditional" telecommunications service providers, "public safety/emergency" service providers, "other" information technology (IT)/telecommunication application service providers (ASP), IP-network access infrastructure/service providers, service and applications providers, third-party service providers, telematics, poison control, medical alert, central alarm monitoring, relay services, and N-1-1 services

The value of each scenario was calculated by identifying and estimating benefits (value) within four categories (value factors) representing the viewpoints across key stakeholders. These value factors were Direct User, Operational/Foundational, Strategic/Political, and Social. Definitions of these factors and the stakeholder groups they encompass are presented in Exhibit ES-5.

Exhibit ES-5: Value Factors Defined

Value Factor	Definitions
Direct User	Value to all direct users of the network, including all callers, the hearing and sight impaired, system operators, and organizations that use 9-1-1 systems and processes to exchange information in emergencies
Operational / Foundational	Value associated with current federal, state, and local government 9-1-1 operations, the order of magnitude improvements realized in current 9-1-1 operations and processes, and in laying the groundwork for future initiatives
Strategic / Political	Contributions to achieving both public (federal, state, and local governments) and private sector strategic goals and priorities
Social	Value related to non-direct users (i.e., those not immediately involved in specific 9-1-1 incidents), communities of stakeholders, the larger economy, and society as a whole

Key value elements of the 9-1-1 system overall were identified and weighed through feedback received from a range of selected 9-1-1 system stakeholders and stakeholder representatives.[4] Results indicate that the greatest value of 9-1-1 relates to the direct user measures. Foundational and operational values were determined to be of next importance. The five highest weighted value measures across all scenarios were—

- **Accessibility.** 9-1-1 system is equally accessible to all members of the general public. The system is also equally accessible to all PSAP call takers
- **Reliability of Service.** 9-1-1 system has no single point of failure and has established redundancy to minimize service disruptions and limit susceptibility to failure and/or natural disaster
- **Call Taker Timeliness.** 9-1-1 calls are received and processed by PSAP call takers and handed off to emergency responders in a timely manner
- **Public Safety.** The system provides for the general safety of the public (e.g., reduced congestion, increased communications in the case of public emergencies, etc.)
- **Safety to Responder.** The team responding to automated emergency calls has all of the information necessary to address the situation appropriately

Performance and effectiveness metrics were defined for each of the key value measures and scored (performance estimating) across the various deployment scenarios. Performance estimating was conducted at a high level by rating how each of the scenarios would perform given the defined metric on a scale of 1 to 5. The current environment was ranked as an "average" indicator of 3 given that national 9-1-1 metrics are typically not normalized and aggregated on a nationwide basis, while the NG9-1-1 scenarios were assessed against this average performance measure. These scores were defined at the metric level and then weighted by the value factor and measure level, giving a "value score" for each individual value measure. Stakeholder representatives and SMEs conducted the evaluation across scenarios, and aggregated the value measure scores to arrive at an overall value score for each deployment scenario. Value analysis findings are presented in Exhibit ES-6.

[4] Sample size of 30 represented a broad range of stakeholders.

Exhibit ES-6: Value Analysis Results

		9-1-1 Baseline*	NG9-1-1 Uniform*	NG9-1-1 Hybrid*
Value Factors and Measures	**Weight**	**Score**		
Direct User Value	**34%**	**17.2**	**33.7**	**32.1**
Accessibility	29%	4.9	9.8	9.0
Call Taker Timeliness	25%	4.2	7.8	8.1
Reliability of Service	27%	4.6	9.3	8.1
Ease of Use	20%	3.4	6.8	6.8
Foundational/Operational Value	**29%**	**14.5**	**21.5**	**20.6**
Scalability & Adaptability of System Functionality & Usage	24%	3.5	7.0	7.0
Information Accuracy	24%	3.4	4.3	4.3
Data Management & Sharing	15%	2.2	4.4	3.8
Operational Efficiency	18%	2.6	5.2	4.9
Security and Privacy	19%	2.8	0.7	0.7
Strategic / Political Value	**18%**	**9.2**	**17.6**	**16.6**
Alignment of Strategic Goals	16%	1.5	2.2	2.2
Technology Standards, Laws, & Regulations	25%	2.2	4.5	4.2
Coordination Between PSAPs at Local, State and International Levels as well as with Other Public Services	28%	2.6	5.2	4.8
Strategic Use of Resources and Data	19%	1.8	3.5	3.1
Value to Industry	12%	1.1	2.3	2.3
Social Value	**18%**	**9.2**	**17.3**	**17.3**
Public Safety	43%	4.0	6.9	6.9
Safety to Responder	41%	3.7	7.4	7.4
Energy & Environment	16%	1.5	2.9	2.9
Total	**100%**	**50.0**	**90.2**	**86.6**

The NG9-1-1 Uniform and Hybrid deployment scenarios consistently scored higher values than the Baseline (current) environment, especially on measures such as accessibility, reliability of service, and general public safety. Although security and privacy measures in the NG9-1-1 environment scored lower than the current environment, these are driven by the issues associated with moving to an IP-based system where data are potentially more accessible—a factor, in itself, that supports the value of being able to access new and additional data that may be beneficial to response and incident outcomes.[5] The largest point differentials in favor of

[5] Providing the opportunity for the more effective acquisition and application of new information and data, in turn, potentially increases the opportunity for misuse. Also, some of that information and data may be accessed across the public Internet, which generates commensurate security challenges. Privacy, confidentiality of information, and network functional security are all issues for NG9-1-1 systems and applications. Consequently, data rights management is an important systems administration function, as pointed out in the *High Level Requirements* and *Detailed Requirements* reports of this project.

NG9-1-1 came in the measures of Accessibility and Reliability of Service, reflecting the increasing number of ways in which the 9-1-1 network can be accessed and the high value of PSAP-to-PSAP linkages in an NG9-1-1 deployment scenario. Note that the Hybrid NG9-1-1 deployment scenario scored slightly lower than the Uniform NG9-1-1 deployment scenario in a number of value factors and measures. This difference reflects the slight decrease in value that results when a portion of the population adopts a different NG9-1-1 solution path than was found in the Uniform deployment scenario. An important benefit of NG9-1-1 is the opportunity it provides to coordinate resources and share incident-related information and data—all with the intent to maximize efficiency, minimize cost, and promote positive incident outcomes. To the extent that deployments are not strictly unilateral in nature, that opportunity is compromised. In summary, based on the value analysis, the NG9-1-1 Uniform deployment scenario is expected to deliver more than **80 percent** additional value over the current operating environment to the 9–1-1 community. The Uniform scenario would result in greater overall value because it assumes that all networks are based on the same standards, whereas the Hybrid scenario would result in 5 percent of the population adopting proprietary standards.

Risk Analysis

The NG9-1-1 project team factored in the risk inherent to each scenario as a means of adjusting cost and value over the lifecycle. Four steps compose the risk analysis:

- **Develop Risk Structure**—Risks were identified using multiple sources, including a literature review, industry sources, SMEs, and stakeholder representatives.
- **Assign Probability**—For each risk, the probability of occurrence was estimated for each scenario (High, Medium, Low, None).
- **Assign Cost and Value Impact**—For each risk, the potential impact on cost and value was estimated (High, Medium, Low, None).
- **Risk Adjust Costs and Value**—The product of the probability and impact of the risks identified was used to risk adjust (increase) the costs associated with the alternative. Likewise, the product of the probability and value impact score was also used to risk adjust (decrease) the value scores for the scenario. The result of this analysis was a risk-adjusted cost and value score for each scenario.

Seventeen key risks, across eight categories, were identified as applicable to both the current and NG9-1-1 environments. Exhibit ES-7 presents the risk structure.

Exhibit ES-7: Risk Structure

Risk Category	Risk Definition
Program Resources	Increasing costs or incomplete/untimely design and standards owing to monopolies in the supply chain
Technology	Inability of system to meet functional requirements
	Use of proprietary standards (open standards not developed)
	Failure of vendors' systems to keep pace with required system goals, use of workarounds that prevent system development and evolution
Security and privacy	Loss of public confidence over time because of inadequate security levels due to bandwidth limits, internal controls, or degradation of security performance
	Loss of public confidence over time as result of unauthorized access to confidential information
Political / Strategic	Inadequate federal, state, and local legislative or regulatory support
Organizational and Change Management	Minimal stakeholder adoption of new technologies and processes
	Increased call processing time because of volume and complexity of incoming data
	Loss of human capital
	Unwillingness of jurisdictions to set aside traditional or historical parochial interests to collaborate with one another
Business / Industry	Lack of vendor 9-1-1 expertise
	Unwillingness or inability of current private sector service providers to keep up with changing service level requirements
Funding	Unwillingness to share costs (e.g., backbone, interfaces) with other jurisdictions
	Inability of funding models to meet project needs because of surcharge assessment and remittance inadequacies
	Inequity in service resulting from urban-rural funding disparities
Public	Lack of public knowledge and awareness of 9-1-1 system capabilities and functionality

The probability (high, medium, low, or none) of risks occurring in each scenario, as well as the impact on both value and cost, were evaluated to determine a risk factor for each cost element (1.0 Planning, 2.0 Acquisition and Implementation, and 3.0 Operations and Maintenance) and value factor (direct user, operational/foundational, strategic/political, and social).

Cost estimates are based on a variety of assumptions, which if altered, affect the projections. Varying a given component of the cost estimate leads to variance in total 20-year lifecycle costs, investment costs, as well as an array of other outputs derived from the cost model. An uncertainty analysis was conducted for each scenario to ensure that the cost provided incorporated the inherent risk of certain implementation and operations and maintenance activities. The software tool Crystal Ball was used to simulate potential variations in cost assumptions and to track the impact on a variety of cost and economic figures. The overarching benefit of this software program is that it can aggregate the impact of factors such as estimated total costs on a given forecast by simultaneously varying numerous cost assumptions, such as level of effort or labor rates, within a pre-determined and feasible range.

Uncertainty regarding the future environment necessitated an examination of assumptions associated with lifecycle costs. Therefore, each cost assumption that had the greatest uncertainty was bound within an upper and lower range, indicating the potential range of values for that assumption. The full range of the risk-adjusted costs and values is presented in Exhibit

ES-8, based on a range of uncertainty (-25 percent to +50 percent below and above the cost estimated as likely by the project team) applied to those individual cost estimates whose actual future value may differ from the expected values attributed to them by the project team. Results were segmented into low, mid, expected, and high ranges. The expected and high range lifecycle costs were then risk adjusted (application of risk analysis). Exhibit ES-8 presents a summary of expected ranges and risk adjusted lifecycle costs, while Exhibit ES-9 presents a similar summary for risk-adjusted value scores.

Exhibit ES-8: Risk-Adjusted Lifecycle Cost Summary (20-Year Lifecycle)

($ Billion, Nominal)	9-1-1 Baseline*		NG9-1-1 Uniform*	1-1NG9-Hybrid*
	Baseline Low	Baseline High	Total Cost	Total Cost
Risk Adjusted Expected Lifecycle Cost	$66.1	$94.2	$86.3	$82.0
Risk Adjusted Upper Bound Lifecycle Cost	$73.7	$104.5	$96.1	$92.5

Exhibit ES-9: Risk-Adjusted Value Analysis

	9-1-1 Baseline	NG9-1-1 Uniform	NG9-1-1 Hybrid
Estimated Value Score	50.0	90.2	86.6
Risk Adjusted Value Score	38.4	59.6	57.2

Note: "Estimated Value Scores" are totals from Exhibit ES-5 (above)

Once risks were applied to the prospective costs and values of each scenario, results indicated that the NG9-1-1 system will have significant value above and beyond the current environment, while the total lifecycle costs are estimated to be within the range presented for the current environment. Accounting for risks increases the overall cost of a scenario, while the value provided under that scenario will decline. For example, the overall value for both of the NG9-1-1 scenarios (Uniform and Hybrid) is higher than that of the 9-1-1 Baseline environment. However, because transition to a new system is perceived as presenting significantly more risk overall than to maintenance of the current one, the overall risk adjustment is greater for the NG9-1-1 Uniform and Hybrid deployment scenarios than it is for the 9-1-1 Baseline environment. In comparing the risk adjusted value scores across scenarios, the Uniform scenario is predicted to deliver 81.7 percent more value than the current system, with the Hybrid scenario expected to deliver 74.4 percent more value. The expected lifecycle costs, when risk adjusted, range from a prospective cost increase of $23.2 billion to a prospective cost savings of $7.9 billion for the Uniform scenario, or a prospective cost increase of $18.9 billion to a prospective cost savings $12.2 billion for the Hybrid scenario.

While the analysis described above focused on the total cost of implementation, it is likely that various components of next generation systems will be shared at various levels—shared not only with other non-9-1-1 services, but also with non-public safety applications. It is the nature of IP networking that those functions that make such networking possible can be grouped or "layered" by purpose, some of which are generic to those applications resident on the network involved. Thus, common infrastructure that is transparent to specific applications that make 9-1-1 work can be "shared" by all benefiting from the functions these common elements provide. For example, the physical, switching, and transport functions that any such network must provide. Sharing can occur in different ways. 9-1-1 and broader public safety functions can be

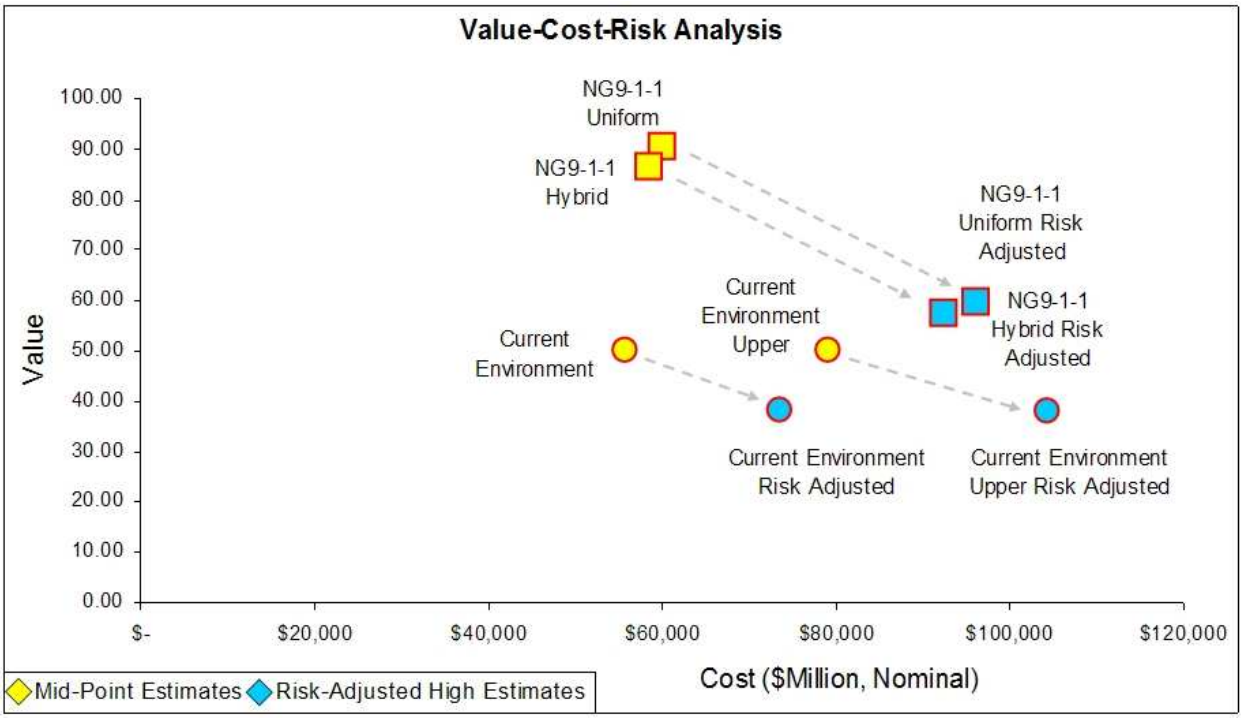
shared among multiple jurisdictions for broad public safety purposes. A state may use a statewide backbone network to support both statewide 9-1-1 system connectivity and other non-public-safety state services. The costs of the common network elements can thus be shared across all functions and applications.

Analysis indicates that while additional risks may need to be mitigated to factor in the benefit of this approach, the cost incurred by the 9-1-1 community will no doubt be positively affected. It is projected that through a joint development and sharing of the data centers and networks inherent to the deployment scenarios defined, cost sharing could reduce the total lifecycle costs to the 9-1-1 authorities by $5.2 billion to $5.7 billion for the Uniform deployment scenario and between $3.2 billion and $4.1 billion for the Hybrid deployment scenario. However, it should be noted that this analysis did not consider any additional costs or risks that may result from establishing and governing more complex cost sharing systems.

Conclusions

Exhibit ES-10 aggregates the results of the cost, risk, and value analysis. NG9-1-1, regardless of deployment strategy, offers significantly higher value for comparative costs in the point estimates. NG9-1-1 continues to deliver significantly greater value when risk adjusted in comparison with the current environment. However, if risks are fully realized, lifecycle costs increase significantly, and the full range of NG9-1-1 lifecycle costs surpasses costs of the current environment.

Exhibit ES-10: Results of Value-Cost-Risk Analysis



Based on the analysis presented for NG9-1-1, we conclude that—

- After adjusting for the risks inherent in the upgrade to an NG9-1-1 system, all NG9-1-1 deployment scenarios have total lifecycle costs that are within the range of the current 9-1-1 environment's lifecycle costs. This makes choosing between NG9-1-1 and today's 9-1-1 largely a function of the value provided by each. This favors either of the NG9-1-1 deployment scenarios.
- NG9-1-1 has the potential to provide significantly greater value than current 9-1-1 technology during the next 20 years by maximizing efficiency, minimizing cost, and promoting positive incident outcome through systems that foster resource sharing and efficiency, information sharing, and new call type applications that support new and more varied ways of communicating and requesting emergency response.
- While the Hybrid deployment scenario adopts multiple approaches and strategies for deployment, additional cost savings ($4.3 billion in comparison to the Uniform scenario 20-year lifecycle cost) may still be realized from the creation of larger networks and data centers that can create economies of scale by providing service to larger populations overall.

Additionally, based on several trends identified during the value analysis process, we conclude that—

- NG9-1-1 provides greater opportunities for cost savings and increased operational efficiencies than the current 9-1-1 environment.
- NG9-1-1 has greater potential to meet the public's expectations for accessibility than the current 9-1-1 environment.
- NG9-1-1 has greater scalability and flexibility than the current 9-1-1 environment.
- NG9-1-1 has greater potential to increase public and responder safety through interconnectivity and interoperability than the current 9-1-1 environment.

Given the importance of 9-1-1 emergency response for public safety, national security, and disaster planning purposes, it is critical that 9-1-1 systems continue to evolve with technology and public demands. This analysis indicates that the preferred solution is to migrate to the NG9-1-1 environment. Ideally, this migration will serve and benefit the entire public safety community. While some risks are inherent to either the Uniform or Hybrid deployment scenarios, both will have greater value and operate within the lifecycle cost range presented by the current 9-1-1 environment.