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Strategic Job Analysis for the Operations Research Analyst (FV-1515) Occupation in the FAA

Dana Broach[1]
Kenneth Seemann[2]

[1]FAA Civil Aerospace Medical Institute
Oklahoma City, Oklahoma

[2] Lockheed-Martin Corporation
Memphis, Tennessee

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16. Abstract

To make aviation safer and smarter, the Federal Aviation Administration (FAA) is building on Safety Management System (SMS) principles to proactively address emerging risks by using consistent, data-informed approaches for system-level decisions through risk-based decision making (RBDM). The Operations Research Analyst (ORA; FV-1515) occupation was identified in 2014 as an occupation critical to the FAA RBDM initiative. The purpose of this research was to describe how work in this critical occupation was likely to change over the next five to seven years as RBDM is implemented. Therefore, a strategic job analysis was conducted in 3 steps: (1) Describe the work as currently performed and the competencies (knowledge, skills, abilities) currently required ("As Is" analysis); (2) Describe the work as it is likely to be performed in the future and the competencies likely to be required ("To Be" analysis); and (3) Evaluate the gap between current and future work and competency requirements ("Gap" analysis). **"As Is" Job Analysis.** Current work (activity, duty, and task) and competency (knowledge, skill, ability) statements were extracted from available job documentation. These statements were used to construct a job analysis survey of all incumbent FAA ORAs (N=174). 101 ORAs completed the job analysis survey. Twelve important, critical and/or important job activities were identified. Sixteen competencies most applicable to ORA work were identified. The analysis identified two communities of practice within the FAA: "Safety ORAs" and "Other ORAs." There was substantial overlap between the two communities in competencies. Subsequent analyses focused on the "Safety ORAs." "**To Be" Job Analysis.** Structured interviews were conducted with supervisory ORAs and managers (N=14). The interview had three major components: (1) assessment of the impact of eight major industry trends on ORA work and competencies in aviation safety, (2) assessment of the impact of the industry trends on ORA job activities and identification of new activities to be performed in the future, and (3) assessment of the impact of these trends on competencies required of ORAs and identification of new competencies. The trends interviewees identified with the greatest likely impact on the ORA occupation were (A) the shift from reactive to proactive oversight of the aerospace industry and (B) integration of unmanned aerial systems (UAS) into the National Airspace System (NAS). "**Gap Analysis."** The work activities of Risk Analysis, Collaboration, and Communication are likely to become more frequent and more important over the next five to seven years (2017 to about 2021-2023). No new activities were identified by the interview respondents. In terms of competencies, Data Analysis, Risk & Hazard Analysis, and Interpersonal Relations abilities are likely to be more important in the future to ORA work. No new competency requirements were identified.
Conclusions. The work of ORAs in the future is likely to be very similar to the ORA job as it is currently performed in terms of the high-level major activities performed and competencies required. However, the analysis of risk, internal and external collaboration, communications of technical analyses and recommendations, and the use of increasingly sophisticated methods and models with ever larger and more complex data sets are expected to become more frequent and more important in the future.

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INTRODUCTION

Risk-based decision making strategic initiative

In February 2014, the Administrator of the Federal Aviation Administration (FAA) announced a set of strategic initiatives focused on making aviation safer and smarter, delivering benefits from technology and infrastructure, enhancing FAA's global leadership, and building the FAA workforce of the future. To make aviation safer and smarter, the FAA intends to build on safety management principles and proactively address emerging risks by using consistent, data-informed approaches to make smarter, system-level, risk-based decisions. This intention will be achieved through the risk-based decision making (RBDM) strategic initiative.

The FAA RBDM strategic initiative has three major sub-initiatives: (a) improving safety data standardization, access, and utilization; (b) enhancing the decision making process; and (c) evolving the agency safety oversight model.

The Improving safety data, standardization, and utilization sub-initiative has five work activities:

1. Establish common data taxonomies to be used consistently across the FAA, when interacting with the aviation industry, and in working with international aviation organizations and partnerships;
2. Align modeling assumptions in systems that model (simulate and predict) National Airspace System (NAS) safety risks;
3. Obtain greater access to sources of data and improve the ability to share data both internally and externally to the FAA;
4. Establish an agency-wide tool to track safety hazards and mitigation outcomes; and
5. Develop functional requirements and competencies for the safety data and risk analytics workforce while identifying current personnel with relevant skills.

This report focuses on the fifth activity—developing functional requirements for the safety data and risk analytics workforce.

The first step in developing functional requirements and competencies for the FAA safety data and risk analytics workforce was to identify the organizational and occupational groups involved in collecting, analyzing, and presenting safety data and risk analytics. Work in FY2014 identified four occupations with primary responsibilities for safety and risk data collection, analysis, and presentation: Operations Research Analyst (ORA; FV-1515), Engineer (FV-08XX), Economist (FV-0110), and Mathematician (FV-1520; Lee-Fanning, Deberry, Smith, & Dumesnil, 2014).

Based on the 2014 work, the ORA occupation was identified as a critical occupation. Subsequent work in FY2015 focused on this occupation with the goals of

(a) Describing what work ORAs perform now and the competencies required,
(b) Forecasting the work and competencies likely to be required of ORAs in the near future,
(c) Identifying any gaps between current and future functional and competency requirements for the occupation, and
(d) Providing recommendations on how to bridge any gaps.

The process for describing present functional and competency requirements, forecasting future requirements, and describing the gap between the “as is” now and the “to be” future for a job or occupation is known as “Strategic Job Modeling” (SJM; Schippman, 1999) and “Strategic Job Analysis” (SJA; Campion, 1994; Knapp, Morath, Quartetti, & Ramos, 1998b; Morath, Knapp, Smith, Ramos, 1998; Peterson & Bownas, 1982; Schneider & Konz, 1989). While the details of technical approaches vary with the authors, the overall concept of a strategic job analysis is straightforward. First, a baseline description of current work and required competencies (knowledge, skills, and abilities (KSAs)) is constructed. This baseline is called the “as is” analysis in this report. Second, internal and external “drivers” of change are identified and their impact on the work performed and competencies required in the focal job assessed. This is called the “to be” analysis in this report. Third, compare the “as is” description to the “to be” forecast to identify critical changes in either the work (functional) or competency (KSA) requirements for the *occupation* as a whole, to create a “gap analysis.” Generally speaking, the gap analysis is more of a qualitative than quantitative exercise in view of the lack of standardized methods or approaches for comparing job/task analyses. Nonetheless, it is a structured qualitative analysis bounded by the scope and range of the “to be” data collected.

It is important to note that a strategic competency or job analysis is focused on the work and competency requirements for the focal job or occupation. The general strategic job analysis approach does not include assessment of *individuals* relative to either current or likely future requirements. Such an evaluation of individuals is beyond the scope of this research.

Organization of report

This report is organized into six major sections. The first section is this introduction. The second section presents the method and results of the baseline “as is” job analysis. The third section presents the method and results of the future “to be” job analysis. The fourth section presents the analysis of the gap between the “as is” and the anticipated future “to be” profile of duties and required knowledge, skill, and abilities (KSAs). The fifth section summarizes the strategic job analysis and presents recommendations. The report closes with a discussion of the approach taken in this strategic job analysis relative to the approach taken in other similar analyses and issues to consider in the planning and execution of a strategic job analysis.

SECTION 2: "AS IS" JOB ANALYSIS

Review of available information

The first step in any job analysis—strategic or otherwise—is to identify and review available information about an occupation or job. The following information sources relevant to the ORA occupation were identified and reviewed:

- Aviation Safety Organization (AVS) Safety management system (SMS) competency guidance dated September 12, 2012;
- *The analysis process—as it applies within Flight Standards: Flight Standards analysis process report* (AFS-900 Analysis Process Development (ADP) Workgroup, 2005);
- Proposed safety training and competencies for ATM safety professionals from FAA/Eurocontrol AP-15 workgroup dated September 23, 2005;
- OPM occupational qualifications standard for ORA (FV-1515) occupation;
- *Risk-Based Decision Making SI-1E FY-14 Closeout Report* (Lee-Fanning, et al., 2014); and
- Job Analysis Tool (JAT) descriptions for ORA positions in FAA organizations (see https://my.faa.gov/employee_services/pay_perf/pay/core_comp_plan.html).

Next, work and competency statements were extracted from the documentation. The ORA JATs were the primary sources for work and competency statements, as the other sources were more abstract and generalized. JATs have replaced more traditional position descriptions in the FAA. A total of 28 ORA JATs from across the agency were obtained from the FAA human resources information systems (Appendix A).

Analysis of work statements

The statements in the JATs describing the *work* performed in an ORA position were decomposed into constituent verb-object work statements by the following rules:

- Break work description into paragraphs (if applicable);
- Break paragraphs down into sentences (based on periods and/or line breaks);
- Break sentences down into clauses (based on semi-colons, commas, colons, prepositions like "to…" and "for…;"
- Break clauses down into verb-object with modifiers;
- Verbs can be 1st person (Analyze), 3rd person (Analyzes), gerund form (Analyzing), and noun form (Evaluation = Evaluate); rewrite all statements into 1st person directive tense (Analyze);
- If a source work statement uses more than one verb in the sentence (for example, "Conduct and/or direct…") rewrite the work statement as two separate statements; and
- When multiple objects are found (like lists of objects - "including analysis X, study Y, etc.), break each into single verb-object pairs (conduct analysis X, conduct study Y, …).

This resulted in 302 verb-object statements. The Excel® pivot table function was then used to create a hierarchical analysis of verb-object pairs, sorted by verb.

The next step in the JAT analysis was to eliminate redundant statements. For example, there were five occurrences of the verb-object pair "Provide findings." This means that five JATs included similar language about providing analysis or study findings. This screening resulted in 218 unique verb-object statements representing basic tasks performed by ORAs.

The third step in the qualitative analysis was to group the 218 verb-object pairs into higher level categories. This step considered the verbs and the objects, grouping like actions and like objects together. Consider the examples shown in Figure 1. Five verb-object pairs included the nouns "audits" and "evaluations" with the verbs "Conduct," "Lead," and "Participate." A sixth statement used the verb "Participate" with the object "reviews of safety programs," which can be considered a specific type or class of evaluations. Another verb-object pair referred to audits. Audits are a regulatory enforcement tool, while evaluations or reviews are less formal and more advisory in nature. Therefore, these six statements were grouped under a higher-level work statement of "Assist in program enforcement and evaluation." Similarly, three low-level work statements (verb-object pairs) referenced teams and were therefore grouped under the higher-level work statement, "Participate in FAA teams and workgroups." A third example is "Providing analytical support," as shown in Figure 1. This higher-level work statement is an abstraction summarizing or encapsulating the four low-level work statements such as "Provided analytical support as needed." Overall, the 218 low-level verb-object pairs were grouped into 32 higher-level work statements for the ORA occupation in this step of the analysis.

Assist in program enforcement and evaluation
Conduct audits
Conduct evaluations
Lead audits
Participate in audits
Participate in evaluations
Participate in reviews of safety programs
Participate in FAA teams and workgroups
Collaborate and coordinate with other FAA offices or organizations
Serve as team leader
Serve as team member
Provide analytical support
Provide analytical support as needed
Provide analytical support in response to requests from other organizations
Support analytical statistical/mathematical models
Support research studies conducted by other organizations
…

Figure 1: Example groupings of low-level verb-object pairs into higher-order work statements

In job analysis, a common rule-of-thumb is to group work statements into 5 to 9 high-level activities (Ammerman, Becker, Jones, Tobey, & Phillips, 1987). Thus, the fourth step of the JAT analysis was to group the 32 higher-level work statements into a smaller number of highest-level groups. Again, statements with similar or parallel content were grouped together subjectively. For example, four higher-level work statements used the verbs "Create," "Produce," "Interpret," and "Present" acting on objects such as "policy interpretations," "research and analysis results," "research results and recommendations," and "reports and other technical documentation." The theme of these four work statements suggested a highest-level work statement of "Communicate results and recommendations," where the verb "communicate" encompasses the notion of creating, producing, interpreting, and presenting information to an audience. The information, in this instance, consists of research results and recommendations in the form of reports and technical documentation (of which this technical report is an example).

This subjective process resulted in twelve overall, highest-level work statements, termed "Activities" for reference. The 32 intermediate "higher-level work statements" were termed "Duties" in keeping with common conventions in civil service job and position descriptions. The 218 low-level work statements were termed "Tasks" for this analysis. The Activity-Duty-Task taxonomy was reviewed by two supervisory ORAs and finalized with minor changes. The final Activity-Duty taxonomy for the job analysis survey is presented in Table 1. The job analysis survey was constructed around the activities and duties to keep the survey to a manageable length.

Three sources of information were used to develop a list of competencies (e.g., KSAs) relevant to the ORA occupation. The first source was the JATs (Appendix A). The second source was the FY2014 RBDM competency survey. The third source was the U.S. Department of Labor *Occupational Information Network* (O*NET; www.onetonline.org). O*NET provides a standardized taxonomy of psychological attributes such as personality and cognitive abilities (Fleishman, Costanza, & Marshall-Mies, 1999).

Table 1: Final ORA Activity-Duty taxonomy for Job Analysis Survey

ACTIVITY	Duty
RESEARCH PLANNING	
	Identify research and analysis requirements
	Plan research and analysis projects
	Review previous studies or analyses
DATA MANAGEMENT	
	Facilitate data harmonization, collection, and sharing
	Administer FAA-owned databases
	Manage data
	Manage data sources
RISK ANALYSIS	
	Analysis failures
	Analyze hazards
	Analyze risks

ACTIVITY	Duty
METHODS AND MODELS DEVELOPMENT	
	Develop methods for analysis and modeling
	Develop software for analysis and modeling
	Develop statistical/mathematical models
DATA ANALYSIS	
	Compute metrics
	Conduct descriptive analyses
	Conduct trend analyses
	Conduct drivers analyses
SOLUTION DEVELOPMENT	
	Develop new solutions or concepts
	Develop new applications of existing solutions and concepts
COMMUNICATION	
	Present research, results, and recommendations
	Produce technical documents
PROGRAM MANAGEMENT	
	Assist in program enforcement and evaluation
	Support program development and implementation activities
COLLABORATION	
	Participate in FAA teams and workgroups
	Provide technical guidance, instruction, & analytical support to FAA and other (external) organizations
	Represent FAA in external workgroups
COST/BENEFIT ANALYSIS	
	Conduct cost/benefit analysis
	Evaluate cost/benefit analyses developed by other organization(s)
BUDGETING	
	Develop organizational budget
	Develop supporting documents
CONTRACT MANAGEMENT	
	Develop statement(s) of work and supporting documents
	Administer contract(s)

Analysis of competency statements

Development of the competency catalog from the JATs followed a strategy similar to the one used to identify work statements. First, the parts of the JATs describing competencies (e.g., KSAs) required were identified and broken into segments based on the key words “knowledge,” “skill,” and “ability.” For example, a statement such as “Skill in utilizing relational data systems and applying operations research methods and techniques in conducting analysis” was broken into two competency statements: “Skill in … utilizing relational data systems” and “Skill in … applying operations research methods and techniques.” Competency statements extracted from the 2014 RBDM Competency Survey were decomposed in a similar manner. For example, one competency statement in the 2014 survey was “Ability to quantify and communicate the risks of hazard outcomes.” This was broken into two statements: “Ability to quantify risks” and “Ability to communicate risks.”

This decomposition process resulted in 287 competency statements. The next step in building the competency catalog was to sort the 287 statements by the prefatory label used in the source document (e.g., "Skill in …," "Knowledge of …," "Ability to …," and "Experience in …"). However, the phrase "Ability to …" was often used colloquially in the source documents. Examples of such use are "Ability to analyze data" and "Ability to compute performance metrics." In applied psychology, the term "ability" refers to an innate characteristic of a person, while "skill" refers to performance of a learned task or behavior. So statements such as "Ability to analyze data" were re-formulated as "Skill in data analysis" and categorized as a (learned) skill rather than as an innate ability. The rephrased competency statements were then sorted into one of four categories: Knowledge ("Knowledge of …"); Skill ("Skill in …"); Ability ("Ability to…"); and Experience ("Experience in …"). Elimination of obvious exact duplicates resulted in a pool of 274 competency statements.

As in the construction of the taxonomy for work statements, the goal of the competency analysis was to categorize the statements at higher levels of analysis and reduce the number of statements to a manageable number. The 274 lowest-level competency statements were then consolidated based on commonalities into 130 competency statements. For example, competency statements such as "Skill in conducting analyses" and "Skill in conducting an analysis," where the difference was use of a plural or singular object, were combined into a single competency statement. Experience statements ("Experience in …") were eliminated as they are generally used as selective placement factors rather than as minimum requirements.

Consolidation of the competency statements and elimination of 28 experience items resulted in a final list of 73 competency (KSA) statements. Wording of the ability statements was tweaked to conform to the psychological definitions used in standard taxonomies such as O*NET. For example, the statement "Ability to adjust how work is performed" was assigned to the "Cognitive Flexibility" ability, defined as "The ability to generate or use different sets of rules for combining or grouping things in different ways, to adjust or adapt to changing situations or conditions." For convenience and understandability, the "other personal characteristics" were re-categorized as "abilities." These steps resulted in a list of 73 ORA competency (KSA) statements, which are presented in Table 2.

Table 2: Final ORA competency (knowledge, skill, ability) taxonomy for job analysis survey

DOMAIN	Competency
KNOWLEDGE	
	Advanced mathematics (through calculus)
	Audit procedures and processes
	Aviation safety-data resources
	Aviation system safety standards
	Cost estimating procedures in federal procurement
	Cost/benefit analysis methods, procedures, and requirements
	Data visualization methods, technologies, and techniques
	Database structure, procedures, maintenance, management, and administration

DOMAIN	Competency
	Decision support system design
	Design, development, validation, and use/operation of decision support systems
	Enterprise architecture concepts, methods, and tools
	FAA leadership agenda
	FAA organization, mission, functions, and operations
	Facilitation techniques for group discussions
	Federal (FAA) procurement procedures and documentation
	Federal aviation regulations
	Mathematical logic
	Methods and techniques for analyzing and representing system behavior over time
	Methods for quantifying scope, scale, frequency, prevalence, and incidence of hazard
	PC/workstation hardware, peripherals (printers, etc), and operating system
	Predictive methodologies
	Principles, procedures, and practices in labor relations
	Probability theory and its applications
	Qualitative methods in scientific inquiry and research
	Quality control procedures in data analysis
	Quantitative methods in scientific inquiry and research
	Scientific method, inquiry, and analysis
	SMS principles, policies, processes, and tools as applied to aviation
	Software application development and testing methods and techniques
	Statistical analysis methods and techniques
	Structure and operations of certified air carriers, supplemental, cargo, and air taxi organizations
	Structure and operations of fixed base operators, flight schools, and other non-maintenance aviation organizations
	Structure and operations of maintenance and repair organizations, overhaul facilities, aircraft manufacturers, and part suppliers
	System analysis methods and techniques
	Systems design principles and practices
	Theories, principles, methods, techniques, and tools for modeling and simulation
	Theory, principles, methods, and practices of operations research
SKILL	
	Adaptation of existing or development of new analytical tools and methods
	Communicating complex, technical, analytic results through a variety of media
	Conflict resolution
	Cost/benefit analysis
	Data screening (cleaning, checking for bad data, etc)
	Data selection
	Data transformation
	Database design, development, and administration
	Development of procurement (acquisition) documents
	Executing research studies
	Extraction of data from a variety of automated sources
	Hazard analysis
	Program evaluation
	Project planning
	Providing technical guidance
	Risk analysis

DOMAIN	Competency
	Statistical analysis
	Trend analysis
	Using common office peripherals such as networked scanners, printers, and fax machines
	Using general office automation applications (Word, Excel, etc)
	Using keyboard and mouse
ABILITY	
	Adjust or adapt to changing situations or conditions
	Apply general rules to a specific problem or work situation
	Apply ideas, concepts, and practices from multiple disciplines and/or perspectives to create solutions to problems
	Combine or group objects or ideas
	Establish rapport and trust with others
	Identify a potential or existing problem
	Identify differences or conflicts among individuals
	Organize and direct a group in pursuit of a mutual goal
	Organize ideas and facts generated by analysis into an integrated framework or meaningful whole
	Perceive underlying patterns by which observed data or information might be organized
	Perceive, understand, and respond to verbal and non-verbal interpersonal cues in the course of working with others
	Persist in efforts over long periods of time
	Present information in order to influence the opinions or actions of others
	Rapidly recover normal energy and enthusiasm following a discouraging situation, setback, or unanticipated outcome
	Reason from observed data or information to general rules

The ORA "As Is" Job Analysis Survey

Survey content

The work and competency statements derived through analysis of JATs and other information sources were used to create the "As Is" *ORA Job Analysis Survey* in SurveyMonkey®. To differentiate among the duties of ORAs in terms of safety-related versus other work, the survey asked respondents to indicate the proportion of time spent on the following broad areas of work in the FAA:

- Contracts (not related to construction),
- Construction,
- Air traffic operations,
- Safety—industry/non-FAA operations,
- Safety—FAA operations,
- Systems engineering/development/modernization, and
- Other.

These seven work areas correspond to types of work described in the JATs. For example, the ORA JATs from the AJR-2000 organization referenced NAS system operations (consistent with the mission of AJR, the ATO Systems Operations Service). In contrast, the ORA JATs from the

AFI-200 organization referenced preparation of contract-related documents such as Independent Government Cost Estimates and Statements of Work (consistent with the mission of the Office of Investment Planning and Analysis). These apparent differences illustrate the wide range of duties performed by ORAs in the FAA in applying their analytical skills.

The first section of the survey was built around activities and job duties rather than the lowest-level task statements in order to keep the survey to a reasonable length. Respondents were asked to rate each job duty on two dimensions: Frequency of performance in assigned projects, and importance to success of assigned projects. The response scale for frequency was absolute (that is, not relative to other duties), where *1=Never* and *5=Always*. The response scale for importance was also absolute (that is, not relative to other duties), where *1=Not at all important* and *5=Extremely important*. In the second section of the survey, respondents were asked to rate the applicability of each competency (KSA) statement to their work, where *1=Not at all applicable to my types of analyses* to *5=Extremely applicable to my types of analyses*. Survey participants were also given an opportunity to add job duty, knowledge, skill, or ability statements if they felt something had been omitted or overlooked in the survey.

Data analysis plan

There were five major steps in the data analysis plan. The first step in the data analysis was to determine if there were subgroups of ORAs based on the proportion of time spent in the seven broad areas of work. This analysis provided a basis for identifying those ORAs performing risk and safety analyses as their primary mission ("Safety ORAs") and those whose mission was in other domains ("Other ORAs").

The second step in the data analysis was to compute descriptive statistics for the ratings of job duty frequency, job duty importance, and competency applicability to the job duties performed by respondents. This analysis provided a basis for identifying the subset of duties that might be considered the core, essential, critical and/or important job duties for the occupation.

The third step in the analysis was to analytically group competency (KSA) statements into higher-order groupings using exploratory factor analysis (EFA). This step established parallel levels of description for both work (activity, duty) and competency (domain, competency) statements for ORAs.

The fourth step in the analysis was to determine the degree of overlap between Safety and Other ORAs by comparing mean (average) ratings by group for all duties using a standard *t*-test. This analysis provided a basis for identifying common and different duties performed by and competencies required of Safety and Other ORAs. Together, these in-common work and competency statements constitute core job descriptions for Safety and Other ORAs.

The fifth and final step in the data analysis plan was to review and characterize any write-in work and competency statements.

Results of the ORA Job Analysis Survey

Participants

A list of all FAA personnel in the FV/FG-1515 occupation was obtained from the FAA Personnel and Payroll System (FPPS), the official system of personnel records, in January 2015. As of that date, 178 persons carried the 1515 occupational designator. Between January 2015 and June 2015, when the survey was conducted, the target population shrank to 171 persons because of retirements and other attrition. The distribution of ORAs across the FAA is presented in Table 3 by major organization. Participation in the survey was voluntary. Overall, 114 ORAs completed the survey, for a response rate of 67%.

Table 3: *N* ORAs by organization and participation in 2015 ORA "as is" job analysis survey

Organization	Description	*N* ORAs	*N* Respondents	*Response Rate*
AFN	Finance and Management	22	10	45%
ANG	NextGen	42	14	33%
APL	Policy, International Affairs, & Environment	6	3	50%
ARP	Airports	3	2	67%
AJR	Air Traffic Organization System Operations	12	6	50%
AJV	Air Traffic Organization Mission Support Services	18	10	56%
ATO	All other Air Traffic Organization services	3	1	33%
AFS	Aviation Safety Flight Standards Service	42	35	83%
AOV	Aviation Safety Air Traffic Oversight Service	4	0	0%
AVP	Aviation Safety Accident Analysis & Prevention	13	10	77%
AVS	All other Aviation Safety organizations	6	4	67%
	(Other or no response on survey)		19	-
	(Totals)	171	114	67%

Participant tenure in the FAA is presented in Table 4. Of the 101 ORAs responding to the question, just over a third (36%) had been with the FAA five or fewer years, 31% had been with the FAA six to ten years, and about 34% had been with the FAA for 11 or more years (percentages do not add up to 100% due to rounding).

Table 4: Tenure in the FAA and in current job

FAA Tenure	N	%	Job Tenure	N	%
0 - 5 years	36	36%	≤ 2 years	30	30%
6 - 10 years	31	31%	3-4 years	17	17%
11 - 15 years	11	11%	5-7 years	26	26%
16 - 20 years	12	12%	8-10 years	12	12%
21 or more years	11	11%	≥ 11 years	16	16%
No response	13	11%	No response	13	11%
Total	114		Total	114	

Participant tenure in current position is also presented in Table 4. About 30% of the participating ORAs had been in their current position two or fewer years, 17% had been in their current position three to four years, about a quarter (26%) of the respondents had been in their current position for five to seven years, and just over a quarter (28%) had been in their current position eight or more years (percentages do not sum to 100% due to rounding).

The proportion of time spent in each of the seven major activities (Contracts [other than construction]. Construction, Air traffic operations, Safety—industry/non-FAA operations, Safety—FAA operations, Systems engineering/development/modernization, and Other) is presented in Table 5 overall and by respondent organization. ORAs in the Flight Standards Service (AFS), Aircraft Certification Service (AIR), Accident Analysis and Prevention (AVP) Service, Air Traffic Oversight Service (AOV), Air Traffic Organization (ATO) Program Management Office (AJM), and ATO Safety and Technical Training (AJI) organizations indicated spending a majority of their time on industry and/or FAA-related safety activities. These 56 respondents were categorized as "Safety ORAs" for purposes of this analysis. The ORAs from other organizations indicated spending the majority of their time on other activities not directly related to safety in the National Airspace System (NAS; e.g., construction, contracts, and systems engineering/development). These 58 respondents were categorized as "Other ORAs" for this analysis. Analyses in this report are based on both groups, with comparisons as appropriate.

Descriptive statistics for duty statements

Descriptive statistics for job duty frequency and importance are presented in Table 6 and Table 7 respectively. Job duties with an average frequency rating of 3.5 (mid-way between "*Frequently*" (3) and "*Often*" (4)) or greater were classified as "more frequently performed" compared to other duties. Thirteen out of the 32 job duty statements were classified as "more frequently performed" by this rule. The activities with more frequently performed duties were (a) RESEARCH PLANNING, (b) COMMUNICATION, (c) DATA MANAGEMENT, (d) DATA ANALYSIS, (e) RISK ANALYSIS, (f) METHODS AND MODELS DEVELOPMENT, and (g) COLLABORATION. Similarly, duties with an average importance rating of 3.5 (mid-way between "*Important*" and "*Very Important*") or greater were classified as "more important" relative to other duties. Twenty out of the 32 duty statements were classified as "more important" using this rule. The activities with more important duties were (a) RESEARCH PLANNING, (b) COMMUNICATION, (c) DATA MANAGEMENT, (d) DATA ANALYSIS, (e) RISK ANALYSIS, (f) METHODS AND MODELS DEVELOPMENT, (g) COLLABORATION, and (h) SOLUTION DEVELOPMENT. Job duties meeting either of these criteria (more frequently performed or more important) were classified as the core, critical, and/or important job duties performed by ORAs (Table 8). Of the 32 job duties performed by ORAs in the FAA, 25 were classified as "core duties."

Table 5: Percent time spent on activity by organizational unit (office or service)

	Contracts (not construction)		Construction		Air traffic operations		Safety – Industry operations		Safety – FAA operations		Systems engineering/ Modernization		Other activity	
FAA Office or Service	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
AFN Finance & Management	2.7	4.8	0.8	1.8	11.5	23.1	0.5	1.6	2.0	2.6	14.0	17.9	68.5	39.0
AFS AVS Flight Standards Service	0.6	3.4			3.2	8.0	19.4	29.3	64.4	37.9	3.7	11.5	8.7	23.5
AIR AVS Aircraft Certification Service							29.0	40.1	41.0	28.8	16.0	24.3	14.0	21.9
AJI ATO Safety & Technical Training	10.0	0.0			25.0	0.0			50.0	0.0	15.0	0.0		
AJM ATO Program Management Office					0.0	0.0					75.0	0.0	25.0	0.0
AJR ATO System Operations	5.3	8.2	0.5	1.2	76.7	38.4	0.2	0.4	1.2	2.0	0.3	0.8	15.8	36.4
AJV ATO Mission Support Services	5.6	7.9	38.5	34.1	12.2	17.2	2.0	4.2	3.5	6.7	16.8	13.9	21.4	41.7
ANG NextGen	4.6	13.2			34.6	34.7	8.4	12.0	8.8	12.4	25.7	33.2	17.9	37.2
AOV AVS Air Traffic Oversight Service	0.0	0.0			13.3	23.1	16.7	28.9	53.3	25.2	16.7	5.8		
APL Policy, International, & Environment					10.0	17.3					33.3	57.7	56.7	51.3
AQS AVS Quality, Integration & Executive Services											100.0	0.0	0.0	0.0
ARP Airports	2.5	3.5	25.0	35.4			12.5	17.7			30.0	28.3	30.0	28.3
AVP AVS Accident Analysis & Prevention Service	0.5	1.6			4.0	7.4	27.0	34.0	65.0	33.8	3.5	6.3		
Total	2.2	6.6	4.4	16.1	14.1	26.7	13.0	24.5	34.7	39.1	13.0	23.3	18.6	34.5

Table 6: Duty frequency descriptive statistics

ACTIVITY/Duty_ID	Duty description	*Mean*	*SD*	*Min*	*Max*	*N*
RESEARCH PLANNING						
Duty_01	**Identify research and analysis requirements**	**4.1**	0.9	1	5	97
Duty_02	**Plan research and analysis projects**	**4.0**	1.0	1	5	98
Duty_03	**Review previous studies or analyses**	**3.6**	1.0	2	5	98
DATA MANAGEMENT						
Duty_04	**Facilitate data harmonization, collection, and sharing**	**3.9**	1.0	1	5	99
Duty_05	Administer FAA-owned databases	2.9	1.5	1	5	99
Duty_06	**Manage data**	**3.8**	1.3	1	5	99
Duty_07	Manage data sources	3.3	1.4	1	5	99
RISK ANALYSIS						
Duty_08	Analysis failures	2.9	1.2	1	5	98
Duty_09	Analyze hazards	3.2	1.4	1	5	98
Duty_10	**Analyze risks**	**3.7**	1.2	1	5	98
METHODS AND MODELS DEVELOPMENT						
Duty_11	**Develop methods for analysis and modeling**	**3.7**	1.2	1	5	98
Duty_12	Develop software for analysis and modeling	2.5	1.4	1	5	98
Duty_13	Develop statistical/mathematical models	3.1	1.2	1	5	98
DATA ANALYSIS						
Duty_14	**Compute metrics**	**3.8**	1.2	1	5	97
Duty_15	**Conduct descriptive analyses**	**3.8**	1.1	1	5	96
Duty_16	**Conduct trend analyses**	**3.7**	1.2	1	5	96
Duty_17	Conduct drivers analyses	3.1	1.3	1	5	94
SOLUTION DEVELOPMENT						
Duty_18	Develop new solutions or concepts	3.4	1.1	1	5	97
Duty_19	Develop new applications of existing solutions and concepts	3.1	1.3	1	5	97
COMMUNICATION						
Duty_20	**Present research, results, and recommendations**	**4.0**	1.0	1	5	96
Duty_21	Produce technical documents	3.4	1.3	1	5	96
PROGRAM MANAGEMENT						
Duty_22	Assist in program enforcement and evaluation	2.7	1.3	1	5	96
Duty_23	Support program development and implementation activities	3.1	1.4	1	5	96
COLLABORATION						
Duty_24	**Participate in FAA teams and workgroups**	**3.7**	1.1	1	5	96
Duty_25	**Provide technical guidance, instruction, and analytical support to FAA and other (external) organizations**	**3.6**	1.1	1	5	96
Duty_26	Represent FAA in external workgroups	2.5	1.4	1	5	96
COST/BENEFIT ANALYSIS						
Duty_27	Conduct cost/benefit analysis	2.6	1.3	1	5	96
Duty_28	Evaluate cost/benefit analyses developed by other organization(s)	2.2	1.2	1	5	96
BUDGETING						
Duty_29	Develop organizational budget	2.0	1.4	1	5	95
Duty_30	Develop supporting documents	3.0	1.4	1	5	95
CONTRACT MANAGEMENT						
Duty_31	Develop statement(s) of work and supporting documents	2.1	1.2	1	5	96
Duty_32	Administer contract(s)	1.7	1.2	1	5	96

Notes: Frequency scale 1=*Never*, 2=*Sometimes*, 3=*Frequently*, 4=*Often*, 5=*Always*

Table 7: "As Is" Duty importance descriptive statistics

Activity/Duty_ID	Duty Statement	*Mean*	*SD*	*Min*	*Max*	*N*
RESEARCH PLANNING						
Duty_01	**Identify research and analysis requirements**	**4.3**	0.8	2	5	98
Duty_02	**Review previous studies or analyses**	**4.2**	0.9	1	5	98
Duty_03	**Plan research and analysis projects**	**3.7**	1.0	2	5	98
DATA MANAGEMENT						
Duty_04	**Facilitate data harmonization, collection, and sharing**	**4.3**	0.8	2	5	100
Duty_05	**Administer FAA-owned databases**	**4.2**	1.1	1	5	100
Duty_06	**Manage data**	**3.9**	1.3	1	5	98
Duty_07	Manage data sources	3.4	1.6	1	5	99
RISK ANALYSIS						
Duty_08	**Analysis failures**	**4.1**	1.1	1	5	99
Duty_09	**Analyze hazards**	**3.5**	1.4	1	5	99
Duty_10	Analyze risks	3.3	1.3	1	5	99
METHODS & MODELS DEVELOPMENT						
Duty_11	**Develop methods for analysis and modeling**	**4.1**	1.1	1	5	99
Duty_12	**Develop software for analysis and modeling**	**3.6**	1.2	1	5	99
Duty_13	Develop statistical/mathematical models	3.1	1.6	1	5	99
DATA ANALYSIS						
Duty_14	**Compute metrics**	**4.0**	1.1	1	5	97
Duty_15	**Conduct descriptive analyses**	**4.0**	1.2	1	5	98
Duty_16	**Conduct trend analyses**	**4.0**	1.1	1	5	96
Duty_17	**Conduct drivers analyses**	**3.5**	1.3	1	5	95
SOLUTION DEVELOPMENT						
Duty_18	**Develop new solutions or concepts**	**3.8**	1.1	1	5	98
Duty_19	**Develop new applications of existing solutions and concepts**	**3.6**	1.3	1	5	98
COMMUNICATION						
Duty_20	**Present research, results, and recommendations**	**4.3**	1.0	1	5	97
Duty_21	**Produce technical documents**	**3.7**	1.2	1	5	97
PROGRAM MANAGEMENT						
Duty_22	Assist in program enforcement and evaluation	3.0	1.5	1	5	95
Duty_23	Support program development and implementation activities	3.4	1.4	1	5	96
COLLABORATION						
Duty_24	**Participate in FAA teams and workgroups**	**4.0**	1.1	1	5	96
Duty_25	**Provide technical guidance, instruction, and analytical support to FAA and other (external) organizations**	**3.9**	1.2	1	5	97
Duty_26	Represent FAA in external workgroups	3.0	1.5	1	5	97
COST-BENEFIT ANALYSIS						
Duty_27	Conduct cost/benefit analysis	3.1	1.4	1	5	96
Duty_28	Evaluate cost/benefit analyses developed by other organization(s)	2.5	1.4	1	5	96
BUDGETING						
Duty_29	Develop organizational budget	2.5	1.6	1	5	95
Duty_30	Develop supporting documents	3.3	1.4	1	5	95
CONTRACT MANAGEMENT						
Duty_31	Develop statement(s) of work and supporting documents	2.6	1.5	1	5	97
Duty_32	Administer contract(s)	2.1	1.5	1	5	97

Notes: Importance scale 1=*Not at all important*, 2=*Somewhat important*, 3=*Important*, 4=*Very important*, 5=*Extremely important*

Table 8: ORA Core Activities and duties

ACTIVITY	Duty	Frequency	Importance
RESEARCH PLANNING			
Duty_01	Identify research and analysis requirements	4.1	4.3
Duty_02	Review previous studies or analyses	3.6	3.7
Duty_03	Plan research and analysis projects	4.0	4.2
DATA MANAGEMENT			
Duty_04	Facilitate data harmonization, collection, and sharing	3.9	4.3
Duty_06	Manage data	3.8	4.2
Duty_07	Manage data sources	3.3	3.9
RISK ANALYSIS			
Duty_09	Analyze hazards	3.2	3.5
Duty_10	Analyze risks	3.7	4.1
METHODS & MODELS DEVELOPMENT			
Duty_11	Develop methods for analysis and modeling	3.7	4.1
Duty_13	Develop statistical/mathematical models	3.1	3.6
DATA ANALYSIS			
Duty_14	Compute metrics	3.8	4.0
Duty_15	Conduct descriptive analyses	3.8	4.0
Duty_16	Conduct trend analyses	3.7	4.0
Duty_17	Conduct drivers analyses	3.1	3.5
SOLUTION DEVELOPMENT			
Duty_18	Develop new solutions or concepts	3.4	3.8
Duty_19	Develop new applications of existing solutions and concepts	3.1	3.6
COMMUNICATION			
Duty_20	Present research, results, and recommendations	4.0	4.3
Duty_21	Produce technical documents	3.4	3.7
COLLABORATION			
Duty_24	Participate in FAA teams and workgroups	3.7	4.0
Duty_25	Provide technical guidance, instruction, and analytical support to FAA and other (external) organizations	3.6	3.9

Notes: Frequency scale 1=*Never*, 2=*Sometimes*, 3=*Frequently*, 4=*Often*, 5=*Always*; Importance scale 1=*Not at all important*, 2=*Somewhat important*, 3=*Important*, 4=*Very important*, 5=*Extremely important*. Only duties with a rating of 3.5 or greater on either frequency or importance categorized as "core" duties for the occupation.

Descriptive statistics for competency (KSA) statements

Descriptive statistics for competencies (KSAs) are presented in Table 9. As in the analysis of job duties, any competency statement with an average rating of 3.5 or greater on the "Applicable to my types of analyses" rating scale was classified as "more applicable" than other statements. Of the 37 knowledge statements, 21 were classified as "more applicable" to the types of analyses performed by ORAs. These 21 knowledge statements are boldfaced in Table 9. The most highly rated knowledge statements (on a 1 to 5 point scale) were "Mathematical logic" (*M*=3.24), "Data visualization methods, technologies, and techniques" (*M*=4.04), and "Statistical analysis methods and techniques" (*M*=4.03). Of the 21 skill statements, 13 were classified as "more applicable" to the types of analyses performed by ORAs. These 13 skill statements are also boldfaced in Table 9. Interestingly, the two most highly rated skills pertained to using common office automation tools. All 15 ability statements were rated at 3.5 or higher and, thus, were classified as "more applicable" to the types of analyses performed by ORAs.

Table 9: Knowledge, Skill, and Ability (KSA) ratings

ID	KSA Statement	Mean	SD	Min	Max	N
	Knowledge Statements					
Kw_01	Advanced mathematics (through calculus)	3.33	1.140	0	4	94
Kw_02	Audit procedures and processes	2.94	1.319	0	4	95
Kw_03	**Aviation safety-data resources**	**3.79**	**1.353**	**0**	**4**	**96**
Kw_04	**Aviation system safety standards**	**3.65**	**1.319**	**0**	**4**	**95**
Kw_05	Cost estimating procedures in federal procurement	2.44	1.500	0	4	96
Kw_06	Cost/benefit analysis methods, procedures, and requirements	2.83	1.397	0	4	96
Kw_07	**Data visualization methods, technologies, and techniques**	**4.04**	**1.132**	**0**	**4**	**96**
Kw_08	**Database structure, procedures, maintenance, management, and administration**	**3.69**	**1.300**	**0**	**4**	**96**
Kw_09	Decision support system design	3.23	1.302	0	4	96
Kw_10	Design, development, validation, and use/operation of decision support systems	3.28	1.367	0	4	96
Kw_11	Enterprise architecture concepts, methods, and tools	2.91	1.255	0	4	95
Kw_12	FAA leadership agenda	3.15	1.330	0	4	96
Kw_13	**FAA organization, mission, functions, and operations**	**3.61**	**1.137**	**0**	**4**	**96**
Kw_14	Facilitation techniques for group discussions	3.27	1.147	0	4	96
Kw_15	Federal (FAA) procurement procedures and documentation	2.41	1.307	0	4	94
Kw_16	**Federal aviation regulations**	**3.59**	**1.157**	**0**	**4**	**96**
Kw_17	**Mathematical logic**	**4.24**	**1.044**	**0**	**4**	**96**
Kw_18	**Methods and techniques for analyzing and representing system behavior over time**	**3.86**	**1.206**	**0**	**4**	**94**
Kw_19	**Methods for quantifying scope, scale, frequency, prevalence, and incidence of hazard**	**3.72**	**1.351**	**0**	**4**	**96**
Kw_20	**PC/workstation hardware, peripherals (printers, etc), and operating system**	**3.92**	**1.254**	**0**	**4**	**96**
Kw_21	**Predictive methodologies**	**3.51**	**1.231**	**0**	**4**	**96**
Kw_22	Principles, procedures, and practices in labor relations	2.06	1.204	0	4	96
Kw_23	**Probability theory and its applications**	**3.54**	**1.192**	**0**	**4**	**95**
Kw_24	**Qualitative methods in scientific inquiry and research**	**3.67**	**1.228**	**0**	**4**	**96**
Kw_25	**Quality control procedures in data analysis**	**3.64**	**1.180**	**0**	**4**	**96**
Kw_26	**Quantitative methods in scientific inquiry and research**	**3.85**	**1.185**	**0**	**4**	**95**
Kw_27	**Scientific method, inquiry, and analysis**	**3.81**	**1.264**	**0**	**4**	**94**
Kw_28	SMS principles, policies, processes, and tools as applied to aviation	3.35	1.392	0	4	96
Kw_29	Software application development and testing methods and techniques	2.97	1.418	0	4	96
Kw_30	**Statistical analysis methods and techniques**	**4.03**	**1.156**	**0**	**4**	**96**
Kw_31	Structure and operations of certified air carriers, supplemental, cargo, and air taxi organizations	3.05	1.316	0	4	95
Kw_32	Structure and operations of fixed base operators, flight schools, and other non-maintenance aviation organizations	2.57	1.220	0	4	96
Kw_33	Structure and operations of maintenance and repair organizations, overhaul facilities, aircraft manufacturers, and part suppliers	2.60	1.318	0	4	96
Kw_34	**System analysis methods and techniques**	**3.78**	**1.135**	**0**	**4**	**96**
Kw_35	**Systems design principles and practices**	**3.56**	**1.218**	**0**	**4**	**95**
Kw_36	**Theories, principles, methods, techniques, and tools for modeling and simulation**	**3.73**	**1.174**	**0**	**4**	**96**
Kw_37	**Theory, principles, methods, and practices of operations research**	**3.89**	**1.195**	**0**	**4**	**96**

ID	KSA Statement	Mean	SD	Min	Max	N
	Skill Statements					
Sk_01	**Adaptation of existing or development of new analytical tools and methods**	**4.00**	**1.01**	**0**	**4**	**96**
Sk_02	**Communicating complex, technical, analytic results through a variety of media**	**4.18**	**0.93**	**1**	**4**	**96**
Sk_03	Conflict resolution	3.03	1.14	0	4	96
Sk_04	Cost/benefit analysis	2.94	1.36	0	4	96
Sk_05	**Data screening (cleaning, checking for bad data, etc)**	**4.11**	**1.04**	**0**	**4**	**96**
Sk_06	**Data selection**	**4.21**	**0.99**	**0**	**4**	**95**
Sk_07	**Data transformation**	**4.00**	**1.11**	**0**	**4**	**96**
Sk_08	Database design, development, and administration	3.15	1.23	0	4	96
Sk_09	Development of procurement (acquisition) documents	2.11	1.20	0	4	96
Sk_10	Executing research studies	3.39	1.25	0	4	96
Sk_11	**Extraction of data from a variety of automated sources**	**4.27**	**1.00**	**0**	**4**	**95**
Sk_12	Hazard analysis	3.22	1.38	0	4	95
Sk_13	Program evaluation	3.15	1.25	0	4	95
Sk_14	Project planning	3.45	1.18	0	4	95
Sk_15	**Providing technical guidance**	**3.73**	**1.16**	**0**	**4**	**95**
Sk_16	**Risk analysis**	**3.86**	**1.21**	**0**	**4**	**95**
Sk_17	**Statistical analysis**	**4.07**	**1.11**	**0**	**4**	**95**
Sk_18	**Trend analysis**	**4.03**	**1.16**	**0**	**4**	**95**
Sk_19	**Using common office peripherals such as networked scanners, printers, and fax machines**	**3.95**	**1.11**	**0**	**4**	**95**
Sk_20	**Using general office automation applications (Word, Excel, etc)**	**4.57**	**0.78**	**0**	**4**	**95**
Sk_21	**Using keyboard and mouse**	**4.72**	**0.60**	**2**	**4**	**95**
	Ability Statements					
Ab_01	**Adjust or adapt to changing situations or conditions**	**4.38**	**.717**	**1**	**4**	**95**
Ab_02	**Apply general rules to a specific problem or work situation**	**4.28**	**.739**	**1**	**4**	**95**
Ab_03	**Apply ideas, concepts, and practices from multiple disciplines and/or perspectives to create solutions to problems**	**4.47**	**.836**	**0**	**4**	**95**
Ab_04	**Combine or group objects or ideas**	**4.28**	**.859**	**0**	**4**	**95**
Ab_05	**Establish rapport and trust with others**	**4.48**	**.742**	**0**	**4**	**95**
Ab_06	**Identify a potential or existing problem**	**4.51**	**.786**	**1**	**4**	**94**
Ab_07	**Identify differences or conflicts among individuals**	**3.55**	**1.218**	**0**	**4**	**95**
Ab_08	**Organize and direct a group in pursuit of a mutual goal**	**3.89**	**1.047**	**0**	**4**	**95**
Ab_09	**Organize ideas and facts generated by analysis into an integrated framework or meaningful whole**	**4.37**	**.851**	**0**	**4**	**95**
Ab_10	**Perceive underlying patterns by which observed data or information might be organized**	**4.39**	**.854**	**0**	**4**	**95**
Ab_11	**Perceive, understand, and respond to verbal and non-verbal interpersonal cues in the course of working with others**	**3.99**	**.951**	**0**	**4**	**95**
Ab_12	**Persist in efforts over long periods of time**	**4.19**	**.914**	**0**	**4**	**95**
Ab_13	**Present information in order to influence the opinions or actions of others**	**4.23**	**.869**	**0**	**4**	**95**
Ab_14	**Rapidly recover normal energy and enthusiasm following a discouraging situation, setback, or unanticipated outcome**	**3.71**	**1.138**	**0**	**4**	**95**
Ab_15	**Reason from observed data or information to general rules**	**4.20**	**.918**	**0**	**4**	**95**

Note: Response scale 1=*Not at all applicable to the types of analyses I perform*, 2=*Somewhat applicable*, 3=*Moderately applicable*, 4=*Very applicable*, 5=*Extremely applicable to the types of analyses I perform*

While duties were organized logically into super-ordinate activities based on the JAT decomposition, competency (KSA) statements derived from the JATs and psychological literature were not similarly organized into a 2-level hierarchy. Therefore, the statistical technique of exploratory factor analysis was used to group the individual knowledge, skills, and abilities into higher-order competencies to derive a 2-level hierarchy (e.g., Competency-KSA) comparable to the 2-level hierarchy for work statements (e.g., Activity-Duty).

Knowledge statements were grouped into 11 higher-order competencies as shown in Table 10 based on the factor analysis. Skill statements were grouped into four competencies as shown in Table 10. Ability statements were grouped into four competencies as shown in Table 10.

Table 10: Competencies derived through exploratory factor analysis

COMPETENCY KSA_ID	KSA statement	**Loading**
	Knowledge-based Competencies	
CORE OPERATIONS RESEARCH TECHNICAL KNOWLEDGE		
Kw_26	Quantitative methods in scientific inquiry and research	.869
Kw_27	Scientific method, inquiry, and analysis	.809
Kw_24	Qualitative methods in scientific inquiry and research	.781
Kw_25	Quality control procedures in data analysis	.748
Kw_30	Statistical analysis methods and techniques	.666
Kw_21	Predictive methodologies	.655
Kw_23	Probability theory and its applications	.654
Kw_37	Theory, principles, methods, and practices of operations research	.546
Kw_36	Theories, principles, methods, techniques, and tools for modeling and simulation	.543
MATHEMATICAL KNOWLEDGE		
Kw_17	Mathematical logic	.746
Kw_18	Methods and techniques for analyzing and representing system behavior over time	.698
Kw_07	Data visualization methods, technologies, and techniques	.579
Kw_08	Database structure, procedures, maintenance, management, and administration	.559
Kw_01	Advanced mathematics (through calculus)	.532
Kw_19	Methods for quantifying scope, scale, frequency, prevalence, and incidence of hazard	.516
AVIATION INDUSTRY KNOWLEDGE		
Kw_31	Structure and operations of certified air carriers, supplemental, cargo, and air taxi organizations	.858
Kw_33	Structure and operations of maintenance and repair organizations, overhaul facilities, aircraft manufacturers, and part suppliers	.805
Kw_32	Structure and operations of fixed base operators, flight schools, and other non-maintenance aviation organizations	.774
SYSTEMS ANALYSIS KNOWLEDGE		
Kw_34	System analysis methods and techniques	.721
Kw_35	Systems design principles and practices	.718
Kw_02	Audit procedures and processes	.574
DECISION SUPPORT SYSTEM KNOWLEDGE		
Kw_09	Decision support system design	.705
Kw_10	Design, development, validation, and use/operation of decision support systems	.702
Kw_28	SMS principles, policies, processes, and tools as applied to aviation	.480
Kw_11	Enterprise architecture concepts, methods, and tools	.458
Kw_29	Software application development and testing methods and techniques	.705

COMPETENCY KSA_ID	KSA statement	**Loading**
FAA KNOWLEDGE		
Kw_13	FAA organization, mission, functions, and operations	.698
Kw_12	FAA leadership agenda	.490
AVIATION SYSTEM KNOWLEDGE		
Kw_03	Aviation safety-data resources	.708
Kw_04	Aviation system safety standards	.668
Kw_16	Federal aviation regulations	
PROCUREMENT KNOWLEDGE		
Kw_05	Cost estimating procedures in federal procurement	.831
Kw_06	Cost/benefit analysis methods, procedures, and requirements	.797
Kw_15	Federal (FAA) procurement procedures and documentation	.755
Kw_22	Principles, procedures, and practices in labor relations	.676
Kw_14	Facilitation techniques for group discussions	.452
PC/WORKSTATION HARDWARE, PERIPHERALS (PRINTERS, ETC), AND OPERATING SYSTEM (KW_20)		
	Skill-based Competencies	
DATA ANALYSIS SKILLS		
Sk_07	Data transformation	.876
Sk_05	Data screening (cleaning, checking for bad data, etc)	.839
Sk_06	Data selection	.835
Sk_17	Statistical analysis	.759
Sk_01	Adaptation of existing or development of new analytical tools and methods	.735
Sk_11	Extraction of data from a variety of automated sources	.729
Sk_18	Trend analysis	.683
Sk_02	Communicating complex, technical, analytic results through a variety of media	.577
Sk_08	Database design, development, and administration	.465
RISK & HAZARD ANALYSIS SKILLS		
Sk_12	Hazard analysis	.960
Sk_16	Risk analysis	.559
PROGRAM/PROJECT MANAGEMENT SKILLS		
Sk_04	Cost/benefit analysis	.733
Sk_09	Development of procurement (acquisition) documents	.665
Sk_13	Program evaluation	.575
Sk_14	Project planning	.569
Sk_03	Conflict resolution	.548
Sk_10	Executing research studies	
Sk_15	Providing technical guidance	
OFFICE AUTOMATION SKILLS		
Sk_20	Using general office automation applications (Word, Excel, etc)	.903
Sk_21	Using keyboard and mouse	.762
Sk_19	Using common office peripherals such as networked scanners, printers, and fax machines	.495
	Ability-based Competencies	
DEDUCTIVE REASONING ABILITIES		
Ab_01	Adjust or adapt to changing situations or conditions	.769
Ab_03	Apply ideas, concepts, and practices from multiple disciplines and/or perspectives to create solutions to problems	.750
Ab_02	Apply general rules to a specific problem or work situation	.709
Ab_06	Identify a potential or existing problem	.604
Ab_04	Combine or group objects or ideas	.570

COMPETENCY KSA_ID	KSA statement	**Loading**
INDUCTIVE REASONING ABILITIES		
Ab_10	Perceive underlying patterns by which observed data or information might be organized	.822
Ab_09	Organize ideas and facts generated by analysis into an integrated framework or meaningful whole	.771
Ab_15	Reason from observed data or information to general rules	.619
INTERPERSONAL ABILITIES		
Ab_07	Identify differences or conflicts among individuals	.742
Ab_08	Organize and direct a group in pursuit of a mutual goal	.676
Ab_14	Rapidly recover normal energy and enthusiasm following a discouraging situation, setback, or unanticipated outcome	.670
Ab_11	Perceive, understand, and respond to verbal and non-verbal interpersonal cues in the course of working with others	.624
Ab_13	Present information in order to influence the opinions or actions of others	.540
Ab_05	Establish rapport and trust with others	.487
PERSIST IN EFFORTS OVER LONG PERIODS OF TIME (AB_12)		*.499*

Comparison of Safety and Other ORAs job duties

The next step in the "as is" analysis was to investigate differences in the work performed by and competencies required of Safety versus Other ORAs. The investigation began with differences in the work performed by Safety versus Other ORAs at the activity level of analysis. Statistically significant differences in activities between the two groups of ORAs are summarized in Table 11. The RISK ANALYSIS activity was performed more frequently by Safety than Other ORAs (M_{Safety}=3.54, M_{Other}=2.87, $t(97)=3.32$, $p<.001$). The RISK ANALYSIS activity was also statistically more important, on average, to Safety than Other ORAs (M_{Safety}=3.90, M_{Other}=3.23, $t(97)=3.29$, $p<.001$). In contrast, the COST-BENEFIT ANALYSIS activity was performed less frequently by Safety than Other ORAs (M_{Safety}=2.00, M_{Other}=2.91, $t(94)=-4.18$, $p<.001$). The COST-BENEFIT ANALYSIS activity was also less important to Safety ORAs than to Other ORAs (M_{Safety}=2.39, M_{Other}=3.44, $t(94)=-4.14$, $p<.001$). The BUDGETING activity was also performed less frequently by Safety ORAs than the Other ORAs (M_{Safety}=2.21, M_{Other}=2.85, $t(93)=-3.01$, $p<.01$). BUDGETING was also statistically less important to Safety than to Other ORAs (M_{Safety}=2.55, M_{Other}=3.35, $t(93)=-3.01$, $p<.001$). Similarly, CONTRACT MANAGEMENT was less important to Safety than to Other ORAs (M_{Safety}=1.94, M_{Other}=2.83, $t(95)=-3.25$, $p<.002$). There were no statistical differences between Safety and Other ORAs in the frequency of performance or importance of the other activities.

The analysis by type of ORA indicated that there is a substantial overlap in the activities performed by ORAs in the two "communities of interest" (Safety and Other ORAs) as shown in Table 12. The importance of those activities also appears to be more similar than different for the two ORA communities. While there are differences in the work activities performed by the two communities of ORAs, these differences are more of degree rather than of kind.

Table 11: Activity frequency and importance for Safety vs. Other ORA

Activity Description	Frequency M_{Safety}	Frequency M_{Other}	Frequency *t-test* t	Frequency *t-test* df	Frequency *t-test* p	Importance M_{Safety}	Importance M_{Other}	Importance *t-test* t	Importance *t-test* df	Importance *t-test* p
Research Planning	3.87	3.94				4.01	4.20			
Data Management	3.48	3.51				3.98	4.10			
Risk Analysis	**3.54**	**2.87**	**3.324**	**96**	**.001**	**3.91**	**3.99**			
Methods Development	3.04	3.18				3.88	3.81			
Data Analysis	3.59	3.55				3.72	3.64			
Solution Development	**3.35**	**3.11**				**3.90**	**3.23**	**3.29**	**97**	**0.001**
Communications	3.68	3.68				3.45	3.82			
Program-Project Management	3.06	2.71				3.51	3.64			
Collaboration	3.15	3.43				3.22	3.16			
Cost-Benefit Analysis	**2.00**	**2.91**	**-4.182**	**94**	**.000**	**2.55**	**3.35**	**-3.011**	**93**	**0.003**
Budgeting	**2.21**	**2.85**	**-2.635**	**93**	**.010**	**2.39**	**3.44**	**-4.136**	**94**	**0.000**
Contract Management	**1.71**	**2.15**				**1.94**	**2.83**	**-3.245**	**95**	**0.002**

Notes: Statistics for non-significant t-tests omitted. Comparisons with statistically significant results are bold-faced. Positive sign for t-test indicates Safety ORA ratings are higher than Other ORA ratings; Negative sign for t-test indicates Safety ORA rating are lower than for Other ORAs.

Table 12: Comparison of Activity frequency and importance for Safety vs. Other ORA

Activity Description	Frequency	Importance
Research Planning		
Data Management		
Risk Analysis	Safety ORA > Other ORA	
Methods Development		
Data Analysis		
Solution Development		Safety ORA > Other ORA
Communications		
Program-Project Management		
Collaboration		
Cost-Benefit Analysis	Safety ORA < Other ORA	Safety ORA < Other ORA
Budgeting	Safety ORA < Other ORA	Safety ORA < Other ORA
Contract Management		Safety ORA < Other ORA

Comparison of Safety and Other ORAs competencies

Differences at the competency level were also investigated. The results of these statistical comparisons of knowledge-based competencies by group are presented in Table 13. *AVIATION INDUSTRY KNOWLEDGE* was more applicable to analyses performed by Safety than to Other ORAs (M_{Safety}=3.08, M_{Other}=2.28, $t(94)=3.58$, $p<.001$). *SAFETY KNOWLEDGE* was also more applicable to analyses performed by Safety than to Other ORAs (M_{Safety}=4.15, M_{Other}=3.03, $t(95)=5.69$, $p<.001$). In contrast, *PROCUREMENT KNOWLEDGE* was less applicable to analyses performed by Safety than Other ORAs (M_{Safety}=2.25, M_{Other}=3.08, $t(95)=-4.28$, $p<.001$). There were no statistically significant differences between Safety and Other ORAs in the applicability of the remaining knowledge-based competencies as summarized in Table 13. As with the work done, there appears to be substantial overlap in the knowledge-based competency requirements between the two communities, such that the observed differences are in degree rather than in kind.

Table 13: Statistical comparison of competency importance for Safety vs. Other ORA

Domain	M_{Safety}	M_{Other}	t-test *t*	*df*	*p*	Summary
Math Knowledge	3.90	3.75				
Research Knowledge	3.82	3.64				
Safety Data Knowledge	**4.15**	**3.03**	**5.69**	**94**	**0.000**	**Safety ORA** > Other ORA
Systems Analysis Knowledge	3.68	3.33				
FAA Knowledge	3.40	3.35				
DSS Knowledge	3.30	2.95				
Industry Knowledge	**3.08**	**2.28**	**3.58**	**94**	**0.001**	**Safety ORA** > Other ORA
Procurement Knowledge	**2.25**	**3.08**	**-4.28**	**94**	**0.000**	Safety ORA < **Other ORA**
Office Automation Skills	4.39	4.44				
Data Analysis Skills	4.10	3.86				
Risk & Hazard Analysis Skills	**4.08**	**2.83**	**6.03**	**93**	**0.000**	**Safety ORA** > Other ORA
Program/Project Management Skills	3.08	3.15				
Deductive Reasoning Abilities	4.43	4.33				
Inductive Reasoning Abilities	4.39	4.23				
Persistence Ability	4.26	4.10				
Interpersonal Abilities	4.03	3.90				

Notes: Statistics for non-significant t-tests omitted. Comparisons with statistically significant results are bold-faced. Positive sign for t-test indicates Safety ORA ratings are higher than Other ORA ratings; Negative sign for t-test indicates Safety ORA rating are lower than for Other ORAs.

Significant differences by group were observed for just one of the four *skill-based* competencies. *RISK AND HAZARD ANALYSIS SKILLS* were more applicable to analyses performed by Safety than Other ORAs (M_{Safety}=4.08, M_{Other}=2.83, $t(93)=6.03$, $p<.001$). There were no statistically significant differences on the other skill-based competencies.

Finally, there were no statistically significant differences in the applicability of any Ability-based competency to the types of analyses performed by Safety and Other ORAs, further reinforcing the conclusion that the observed differences are a matter of degree rather than in kind of work performed or competencies required.

Write-in items analysis

Write-in responses for Safety ORAs are presented in Appendix B. Our review found that the additional knowledge, skill, or ability statements were specific instances of one or more of the general work or KSA statements in the survey. The mapping of write-in responses to survey work or KSA statements is also presented in Appendix B. For example, several references to the need for SQL knowledge were made, which is a specific instance of database management knowledge. Other statements were about the need to collaborate and communicate. Statements that could be mapped to existing work or competency statements were not further analyzed. Other statements were more editorial in nature, about the state of the ORA occupation in the FAA, and were presented in Appendix C verbatim without further analysis.

Discussion of "as is" job analysis results

Core job description for ORAs

A core job description for the ORA occupation in the FAA was developed on the basis of the analyses conducted and data generated in the course of this "As Is" job analysis. The ORA core job description is presented in Table 14. Vertically, the table is divided into three columns: Safety ORA (on the left), All ORA (center), and Other ORA (on the right). Horizontally, the table is divided into two rows: Activities performed by ORAs in the upper half, and Competencies required of ORAs in the lower half.

As shown in Table 14, all ORAs perform RESEARCH PLANNING, COMMUNICATIONS, DATA MANAGEMENT, DATA ANALYSIS, and SOLUTION DEVELOPMENT activities. But Safety ORAs also perform RISK ANALYSIS more frequently, while Other ORAs perform BUDGETING, COST-BENEFIT ANALYSES, and CONTRACT MANAGEMENT activities more frequently. These are not absolute allocations of activities between the two groups of ORAs but appear to reflect relative emphases in the work within a particular organization having a particular mission. Similarly, there appear to be core competencies required of all ORAs with some differences in emphasis. For examples, the *AVIATION SYSTEM KNOWLEDGE* and *RISK & HAZARD ANALYSIS SKILLS* competencies are more applicable to Safety-related work, while *PROCUREMENT KNOWLEDGE* is more applicable to the work performed by Other ORAs. As suggested in presenting the results of the comparison, the differences between the two communities of ORAs appear to be primarily a matter of emphasis or degree rather than differences in the kinds of work performed or the competencies required.

Table 14: "As is" ORA job description

Safety ORA Duties	All ORA Duties (Core)	Other ORA Duties
	Research Planning	
	Communications	
	Data Management	
	Data Analysis	
	Solution Development	
Risk Analysis		
	Collaboration	
	Methods Development	
	Program/Project Management	
		Budgeting
		Cost-Benefit Analyses
		Contract Management
Safety ORA Competencies	**All ORA Competencies (Core)**	**Other ORA Competencies**
	Office Automation Skills	
	Deductive Reasoning Abilities	
	Inductive Reasoning Abilities	
	Persistence Ability	
	Data Analysis Skills	
	Interpersonal Abilities	
	Math Knowledge	
Aviation System Knowledge		
Risk & Hazard Analysis Skills		
	Systems Analysis Knowledge	
	FAA Knowledge	
	DSS Knowledge	
	Program & Project Management Skills	
Industry Knowledge		
		Procurement Knowledge

Comparison to 2014 competency analysis

The ORA competencies identified in the 2015 study are compared to the competencies identified in the 2014 study in Table 15. All of the competencies identified in 2014 are included in the 2015 list. The 2015 list of ORA competencies is larger and broader than the 2014 list. However, the 2015 competency list should be regarded as provisional and subject to further development.

Table 15: Comparison of 2015 and 2014 competency lists

2015 Competencies	2014 Competencies
Office Automation Skills *Using general office automation applications (Word, Excel, etc)* *Using keyboard and mouse* *Using common office peripherals such as networked scanners, printers, and fax machines*	**Technology literacy**: Effectively uses computer technology to accomplish major job responsibilities
Deductive Reasoning Abilities *Identify a potential or existing problem* *Apply ideas, concepts, and practices from multiple disciplines and/or perspectives to create solutions to problems* *Adjust or adapt to changing situations or conditions* *Combine or group objects or ideas* *Apply general rules to a specific problem or work situation*	**Critical thinking**: Separates fact from opinion, analyzes information objectively and accurately, and integrates information to arrive at logical conclusions or decisions
Inductive Reasoning Abilities *Perceive underlying patterns by which observed data or information might be organized* *Organize ideas and facts generated by analysis into an integrated framework or meaningful whole* *Reason from observed data or information to general rules*	**System thinking**: Considers the interrelationships among component parts of a dynamic system rather than the parts themselves to understand the issue, avoid unintended consequences, and identify optimal solutions
Persistence Ability	
Data Analysis Skills	
Extraction of data from a variety of automated sources	**Data extracting & inspecting**: Extracting the appropriate data and implement appropriate quality control procedures
Data selection	**Data compiling**: Select appropriate variables for analysis
Communicating complex, technical, analytic results through a variety of media	**Risk communication**: Communicate hazard and risk information to support mitigation strategies **Analytical communications**: Communicate implications from data analytics

2015 Competencies	2014 Competencies
Data screening (cleaning, checking for bad data, etc)	**Data cleaning**: Detect and remove “bad” data
Statistical analysis	**Modeling**: Analyze data using statistical models
Trend analysis	
Data transformation	**Data transforming**: Mathematically manipulate variables into a form suitable for modeling
Adaptation of existing or development of new analytical tools and methods	
Database design, development, and administration	
Interpersonal Abilities	**Collaboration**: Build constructive relationships, enable cooperative and productive group interactions, and promote commitment to achieve goals
Establish rapport and trust with others	
Present information in order to influence the opinions or actions of others	**Communication**: Effectively convey facts and ideas orally and in writing
Perceive, understand, and respond to verbal and non-verbal interpersonal cues in the course of working with others	
Organize and direct a group in pursuit of a mutual goal	
Rapidly recover normal energy and enthusiasm following a discouraging situation, setback, or unanticipated outcome	
Identify differences or conflicts among individuals	
Math Knowledge	
Mathematical logic	
Data visualization methods, technologies, and techniques	
Database structure, procedures, maintenance, management, and administration	
Methods and techniques for analyzing and representing system behavior over time	
Advanced mathematics (through calculus)	

2015 Competencies	2014 Competencies
Aviation System Knowledge *Aviation safety-data resources* *Aviation system safety standards* *Federal aviation regulations*	**Agency-industry aviation knowledge**: Knowledge of the 1) functional and regulatory responsibilities of the Federal Aviation Administration in maintaining the safety and efficiency of the national airspace system and 2) sectors making up the airline industry, including design and manufacturing, maintenance, and transport of goods and services
Risk & Hazard Analysis Skills *Risk analysis* *Hazard analysis* *Methods for quantifying scope, scale, frequency, prevalence, and incidence of hazard*	 **Risk estimation**: Calculate the probability and severity of risk Risk comparison: Identify appropriate benchmarks or standards **Hazard identification**: Leverages safety-related data, analysis methods, and system knowledge to identify and document potential hazards and their consequences
Systems Analysis Knowledge *System analysis methods and techniques* *Systems design principles and practices* *Audit procedures and processes*	
FAA Knowledge *FAA organization, mission, functions, and operations* *FAA leadership agenda*	
DSS Knowledge *SMS principles, policies, processes, and tools as applied to aviation* *Decision support system design* *Design, development, validation, and use/operation of decision support systems* *Software application development and testing methods and techniques* *Enterprise architecture concepts, methods, and tools*	

2015 Competencies	2014 Competencies
Program & Project Management Skills	
Providing technical guidance	
Project planning	
Executing research studies	
Program evaluation	
Conflict resolution	
Cost/benefit analysis	**Risk transformation**: Conduct cost and benefits analyses
Development of procurement (acquisition) documents	
Aviation Industry Knowledge	
Structure and operations of certified air carriers, supplemental, cargo, and air taxi organizations	
Structure and operations of maintenance and repair organizations, overhaul facilities, aircraft manufacturers, and part suppliers	
Structure and operations of fixed base operators, flight schools, and other non-maintenance aviation organizations	
Procurement Knowledge	
Facilitation techniques for group discussions	
Cost/benefit analysis methods, procedures, and requirements	
Federal (FAA) procurement procedures and documentation	
Principles, procedures, and practices in labor relations	
Cost estimating procedures in federal procurement	

SECTION 3: FUTURE "TO BE" JOB ANALYSIS

Technical approach

A variety of technical approaches have been proposed in the job analysis literature to forecast future work and competency requirements (Arvey, Salas, & Gialluca, 1992; Bruskiewicz & Bosshardt, 1996; Campion, 1994; Knapp, Morath, Quartetti, & Ramos, 1998a,b; Schippman, 1999). For this analysis, we selected an interview-based approach modeled on Schippman. Note that having determined from the ORA survey in the first phase of the analysis that only those individuals whose job responsibilities fit into the "Safety ORA" were of interest to the goals and purpose of this study, we culled all "Non-Safety ORAs" from the study population. All subsequent analysis described in this report focuses only on Safety ORAs.

Preparing for the interviews required three steps. First, we identified both external (to FAA) and internal (to FAA) macro-level trends likely to impact the work and competencies required of Safety ORAs, resulting in a list of eight trends. Second, we identified a subset of FAA individuals as "visionaries" to be interviewed. Generally speaking, the "visionaries" were supervisors or managers of Safety ORAs or other managers of forward-looking, innovative, safety-oriented programs within the agency. Third, we developed a structured interview protocol to guide the visionary interviews.

The interview protocol required the visionaries to assess three distinct aspects of the Safety-ORA position. First, visionaries were asked to assess the impact of each of the eight trends on Safety ORA work and competency requirements over the next five to seven years. Second, the visionaries were asked to identify likely changes in the job activities of the Safety ORAs over the next five to seven years. Third, the visionaries were asked to identify and discuss changes in the competencies required of ORAs over the next five to seven years in view of likely changes in Safety ORA job activities. Note that, throughout these steps, the visionaries were also given the opportunity to identify additional trends, job activities, and competencies impacting ORA work not already identified within the interview protocol. To complete the future-oriented "to be" job analysis, we then summarized the quantitative and qualitative data gained from the interviews to develop a "to be" job description for Safety-ORAs.

The next step in the future-oriented "to be" job analysis was to interview a small number of senior FAA executives in the Aviation Safety (AVS) organization about their perspective on how the work and competencies required of ORAs in AVS might evolve. We made adjustments to the Safety ORA "to be" job description established by the visionary interviews based on these executive discussions.

The final step in the "to be" analysis was to qualitatively compare the "as is" job description for Safety ORAs to the "to be" description to evaluate the gap between current and future work and competency requirements.

Trends

To being the first step of the "to-be" job analysis, we identified eight macro-level trends (Figure 2) likely to impact the work performed by, and competencies required of, Safety ORAs.

Unmanned aerial systems (UAS) integration into the National Airspace System
Commercial space operations (CSO) integration into the National Airspace System
Change in FAA oversight role from enforcement to cooperative compliance
Shift from reactive, after-the-fact oversight towards proactive anticipation and prevention
Advances in mathematical modeling
"Big Data" & data analytics
Implementation of the Next Generation Air Transportation System ("NextGen")

Figure 2: Major trends likely to impact the work of FAA safety ORAs

The first trend is the integration of Unmanned Aerial Systems (UAS) into the National Airspace System (NAS). UAS come in a variety of shapes and sizes and serve diverse purposes. They may have a wingspan as large as a Boeing 737 or as small as a radio-controlled model airplane. However, regardless of size or configuration, UAS have one key feature in common: No one is on board to control the aerial vehicle. Rather, someone on the ground typically controls the aerial vehicle via radio. This makes UAS fundamentally different from manned aircraft. The FAA Modernization and Reform Act of 2012 (Public Law 112-95) required the FAA to develop a "roadmap" for incorporating UAS into the NAS by September 2015.

The second trend we identified as likely to impact the work performed by, and competencies required of, Safety ORAs over the next five to seven years is integration of commercial space operations (CSO) into the NAS. Commercial launches are projected to increase to about 200 in 2016, 400 in 2018, and nearly 800 in 2020 (FAA, 2015). Current operational practices for launch and re-entry are conservative, reserving large volumes of airspace over substantial periods of time (Bilimoria & Jastrzebski, 2013). Continued use of this conservative approach is likely to impose substantial economic and operational burdens on other users of the NAS as the number of commercial space operations increases (Bilimoria & Jastrzebski, 2013). Like UAS, the FAA must identify methods to provide equitable access to the NAS by commercial space operations and other NAS users in the near future.

The third trend we identified as likely to impact the work performed by, and competencies required of, Safety ORAs over the next five to seven years is a change in the FAA's oversight role in the NAS. For example, in 2015 FAA issued Order 8000.373 (dated June 26, 2015) setting out the agency's overall oversight philosophy. In the order, FAA recognized that some deviations from regulatory standards are most effectively corrected through root cause analysis, training, education, procedure changes, and training programs to bring the operator back into compliance.

The fourth trend we identified as likely to impact the Safety ORA job is a shift from reactive, after-the-fact oversight towards a proactive framework. Today's NAS relies heavily on enforcement of regulations written in response to past incidents but requires considerable federal resources to monitor more than 2,300 air operators and nearly 4,900 maintenance and repair facilities. A proactive framework would rely more on anticipation and prevention of safety problems.

The fifth trend we identified as likely to impact Safety ORA work and competencies is advances in mathematical modeling of structures, systems, and operations. There has been substantial technical innovation in operations research methods, especially in mathematical modeling and representation of structures, systems, and operations, fueled by increasingly powerful software on high-end workstations. Techniques such as bi-level nonlinear programming, fuzzy multi-objective programming, logical decision trees, and binary decision diagrams are applied to problems ranging from logistics to corporate financing (Lev & Shen, 2015). Statistical simulation, for example, has become a first resort rather than a last resort (Lucas, Kelton, Sanchez, Sanchez, & Anderson, 2015).

The sixth trend we identified is a corollary to the fourth and fifth trends—the concept of "Big Data" and its accompanying emphasis on "analytics." The basic notion is the collection and analysis of huge volumes of data to identify business-related trends and outcomes, often in near real-time (Bollier, 2010; McAfee, & Brynjolfsson, 2012). In the FAA, an example of "Big Data" at work is the fusion of multiple sources of data to describe all flights in the NAS over some period of time (*Data fusion: The future of safety analysis*, 2015). "Big Data" might provide a basis for developing proactive models using advanced mathematical modeling techniques, for example.

The seventh trend we identified is the continuing implementation of the Next Generation Air Transportation Systems (NextGen). NextGen is characterized by GPS-based position, navigation, and timing services, time-based and trajectory-based operations, and shared separation responsibilities between the flight deck and air traffic control, coupled with increasing automation on both sides.

The eighth trend we identified is the increasing automation in the cockpit, migration of automation tools from large aircraft to high-end business aircraft, as well as onto new general aviation aircraft (National Transportation Safety Board, 2010). Modern commercial aircraft are increasingly reliant on automation for safe and efficient operation. The aviation industry and FAA must assess potential risks and benefits of automation in both commercial and light aircraft.

Visionaries

Fourteen visionaries were interviewed for this analysis as the second step in the first step of the "to-be" job analysis. We called them visionaries as we asked them to envision what the job of Safety ORAs would look like in five to seven years. The visionaries also were first or second-level supervisors with programmatic responsibilities, representing the following FAA organizations, with reporting responsibilities as detailed:

- Flight Standards (AFS) -- reports to Associate Administrator for Aviation Safety (AVS)
- Aircraft Certification (AIR) -- reports to AVS
- Air Traffic Oversight (AOV) -- reports to AVS
- Accident Analysis and Prevention (AVP) -- reports to AVS
- Air Traffic Organization Safety and Technical Training (AJI)—reports to Air Traffic Organization (ATO) Chief Operating Officer.

A summary of the visionaries' time spent in the ORA occupation, overall FAA tenure, and tenure in their current position is presented in Table 16. As a group, the visionaries were highly experienced with many years of service and experience in the FAA and ORA domain.

The visionaries were involved with a wide range of programs and served in a variety of roles. Program responsibilities included safety assurance systems as part of the agency Safety Management System (SMS), quality assurance, risk mitigation program evaluation, production of safety and risk documentation for new procedures, accident analysis and modeling, safety, risk information, operational data database development and administration, data sharing program management, policy and rulemaking support, and safety-related research program management. Roles for the visionaries included technical advisor, first and second level manager, and field staff.

Table 16: Visionary time in ORA occupation, FAA tenure, and tenure in current job

	Time in ORA Occupation	FAA Tenure	Position Tenure
Mean (Average)	18 years	15 years	5 years
Standard Deviation	9 years	8 years	5 years
Minimum	10 months	4 years	1 month
Maximum	35 years	26 years	18 years

Interview protocol

The next step of the "to-be job analysis" was to create the visionary interview protocol, which is found in Appendix D. The protocol had five major blocks:

1. Introductions, background of the project, assurance of confidentiality, and collection of basic demographic information.
2. Rate the impact of the eight trends discussed above on the overall job performed by Safety ORAs.
3. Rate the impact of the trends on each of the eleven major work activities of Safety ORAs specifically.
4. Evaluate changes in competencies (KSAs) required of Safety ORAs resulting from the changes in the work driven by the eight trends.

5. Identify the biggest challenge (or challenges) for Safety ORAs and to share any closing thoughts about the future of the ORA occupation.

To provide consistency across all visionary interviews, we developed a PowerPoint® slide presentation, which guided each interview through all five blocks of the process. The presentation ensured all questions were asked using identical terminology in the same order throughout all interviews, as well as providing a secondary reference for interviewees to visualize each question and rating scale as it was read aloud, i.e., they could read along and refer back to the question and rating scale on the screen while providing their responses.

Results of the ORA "To Be" Job Analysis Interviews

Trend impact on ORA work overall

The visionaries rated the impact of each trend on a five-point, Likert-type scale, where 1=*No impact at all on ORA work*, 2=*Very little or minor impact*, 3=*Moderate impact*, 4=*Substantial impact*, and 5=*Very great or extensive impact on ORA work*. We calculated both the mean (average) rating given to each trend and the proportion of visionaries rating each trend as having substantial (4) or very great or extensive impact on ORA work. Table 17 summarizes the visionaries' assessments of each of the eight macro-trends on the safety-ORA's overall job activities and competencies. In some cases, visionaries believed that they had little or no insight into specific trends or did not think they were qualified to comment, and did not provide a rating.

Table 17: Impact on ORA work by trend (sorted high to low on mean impact)

Trend	Mean	SD	N	% High Impact[1]	Rank[2] on Mean	Rank on % High Impact
Shift from reactive to proactive oversight	3.79	1.05	14	76%	8	7
Big Data	3.69	0.95	13	54%	7	4
NextGen implementation	3.50	1.24	12	67%	6	6
Advances in mathematical modeling	3.43	0.85	14	57%	5	5
UAS integration into the NAS	3.38	1.12	13	92%	4	8
FAA regulatory oversight role change	3.23	1.17	13	54%	3	3
CSO integration into the NAS	2.92	1.04	13	31%	2	2
Cockpit automation	2.79	0.97	14	31%	1	1

Notes: [1]"High Impact" defined as percent (%) rating the trend as having "Substantial" or "Very great" impact.
[2]Rank-order where 8 is highest mean or % High Impact and 1 is lowest mean or % High Impact

We rank-ordered the eight trends on two metrics: the mean (average) rating for impact and the percent indicating a trend would have very great or substantial impact on Safety ORA work (i.e., have a “high impact” on the work performed by ORAs). These two measures provide slightly different information about the relative impact of the trends on Safety ORA work. We then compared the trends on the two measures of rank-order impact to determine which trends were consistently ranked in terms of their impact and trends that had less consistent impact.

The two measures were in agreement for six of the eight trends, as shown in Figure 3. The shift from reactive to proactive oversight ranked high on both metrics (mean impact rating =3.79, 79% (11 of 14) rating as “substantial” or “very great” impact). Clearly, the shift to proactive oversight is expected to impact the work of Safety ORAs.

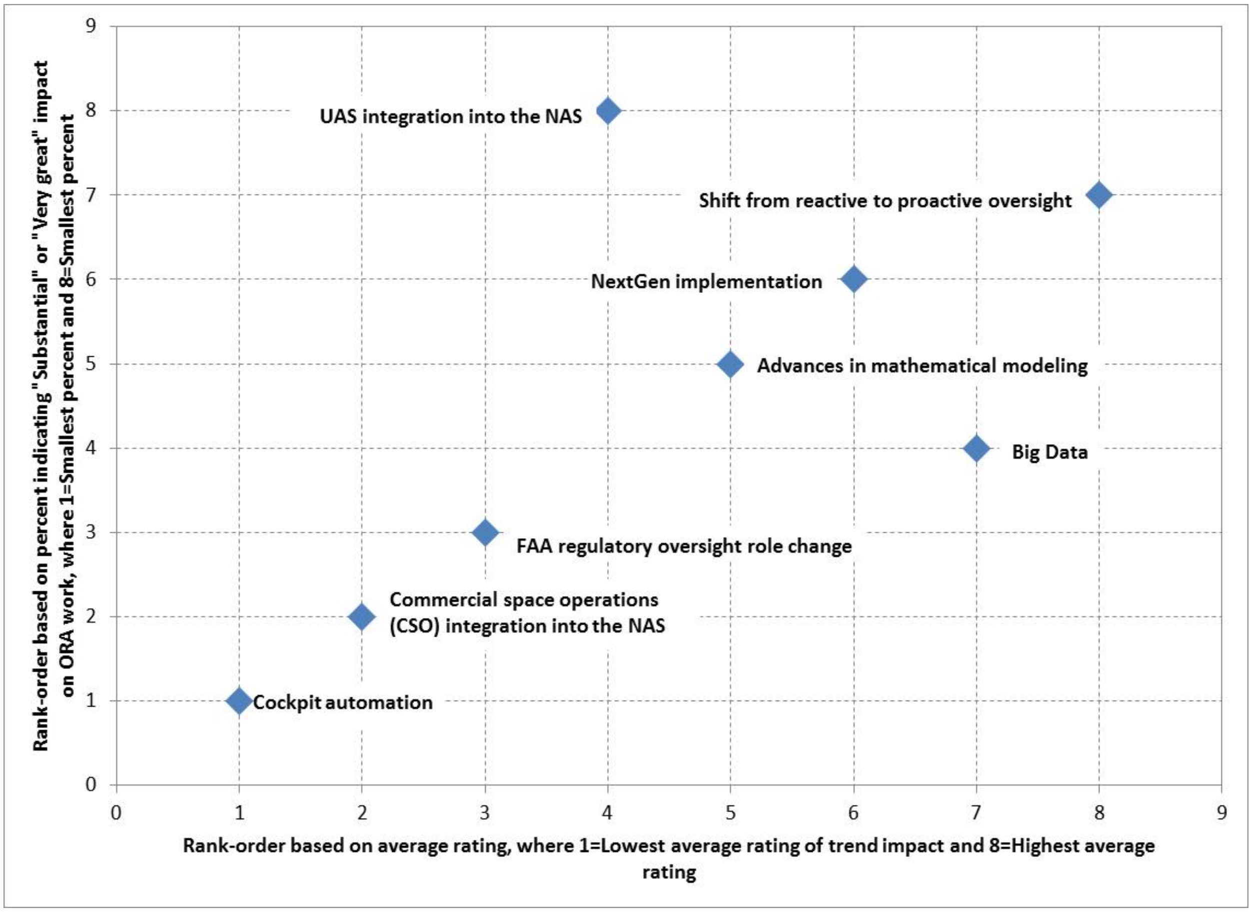

Figure 3: Cross-plot of the rank-order of the eight trends impacting ORA occupation based on the mean impact rating and percent substantial or very great impact

At the other end, trends in cockpit automation and integration of commercial space operations were expected to have much less impact on the work of Safety ORAs over the next five to seven years.

Three trends—change in the FAA regulatory role, advances in mathematical modeling, and NextGen—will have middling degrees of impact on the work based on the rank-ordering on the two metrics.

However, the two measures of rank order disagreed for two trends, “Big Data” and UAS integration, presenting a mixed picture of their impact on ORA work. The mean rating for the impact of “Big Data” was 3.69 on a five-point scale (where 1=*No impact* and 5=*Very great impact*), but only 7 of the 14 visionaries (50%) thought “Big Data” would have substantial or very great impact on the work of Safety ORAs. In contrast, UAS integration had a lower average impact rating of 3.38 (on the five-point scale) but 11 of 13 visionaries thought UAS integration would have substantial or very great impact on Safety ORA work.

Considering these analyses, and taking these disagreements into consideration, we gave more weight to the percent-based ranking than to the average rating in determining which trends were likely to have the greatest impact on ORA work. That resulted in the following rank order for the trends (from greatest to least impact on Safety ORA work):

1. Integration of UAS into the NAS
2. Shift from reactive to proactive oversight
3. Implementation of NextGen
4. Advances in mathematical modeling
5. “Big Data”
6. Changes in the FAA oversight role
7. Integration of commercial space operations
8. Cockpit automation

While we decided that UAS integration into the NAS was the trend with the greatest likely impact, there appears to be uncertainty about UAS integration into the NAS, as reflected in the relatively large proportion of visionaries rating it as having “substantial” or “very great” impact on ORA work but with an average impact rating of just 3.38 (*SD*=1.12 on a 5-point scale). Respondent comments reflected this uncertainty. One visionary commented that “Integrating UAS seamlessly and safely into the NAS is going to be a huge challenge… The human factors of the UAS pilot will also be involved in any analysis of data. The question arises of whether ATC will have the same role with UAS as it does with manned aviation… [We] simply don’t have the data needed to make any of these decisions.” Another respondent noted “There are already weekly and even daily incidents. That represents a huge quantity of these aircraft out there that we need to track data and report on.” Given the recent pace of integration of UAS into the NAS, the issue may be that UAS integration is not five to seven years off in the future—it’s now.

The shift from reactive to proactive oversight is also likely to have substantial impact on the work performed by Safety ORAs. As one respondent stated, “This [proactive oversight] is going to be a large impact on our work because within the aviation industry there are not many accidents in commercial aviation. This means there isn't much data to analyze…So we need to look for errors that could contribute to future failures, because prevention is better than reacting to an accident after it happens.” Another noted that, “This [shift from reactive to proactive oversight] is a change to everything the agency has done for the last 50 years. We now are beginning to look at what may go wrong rather than at what has gone wrong.” Yet another noted that, “[This] is a change in the agency's and [the industry’s] working model. It is no longer agency centric. The ORAs will need to understand the commercial aspects vs. the government aspects and take the needs of both groups into consideration when doing their analysis…”

“Big Data” is one of two trends for which the two metrics disagreed. On one hand, ORAs already work with “Big Data” in terms of the volume, velocity, and variety of the data with which they routinely work. On the other hand, it might be the case that “Big Data” is only going to get even bigger, impacting Safety ORA work. “Big Data” might also represent a change in the “tools of the trade” akin to the advances in mathematical modeling trend. For both, it appears to be a case of changes in the “how” of the work of ORAs rather than changes in the “what” of their work.

Trend impact on specific ORA activities

The natural question that follows is how these trends will impact the work performed by ORAs. In the “as is” baseline job analysis, we identified twelve high-level activities performed by Safety and Other ORAs. The DATA ANALYSIS activity was found to be a pervasive rather than separate activity, an inherent component of all activities except COLLABORATION and COMMUNICATION. Therefore, it was not addressed in the “to be” analysis of the overall impact of eight trends on specific work activities and reduces the total number of activities included in the analysis to eleven.

The eight trends—drivers of change—might impact ORA work by changing the frequency of performance of the high-level activities, by changing their importance, by changing the competencies required to perform the work, or some combination of the three. We asked visionaries if they believed any of these three conditions might occur for the Safety ORAs.

Turning first to changes in the work as a consequence of the eight trends, we asked the visionaries to estimate to what degree the eight trends, taken together, will change how often each of the 11 high-level activities will be performed and whether each of the activities will be more or less important in the future. Visionaries were asked, for each of the eleven activities, whether an activity would be performed more or less frequently than now on a five-point scale where 1=*Much less frequently in the future*, 2=*Less frequently in the future*, 3=*About as often as now (no change)*, 4=*More frequently in the future*, and 5=*Much more frequently in the future*. We emphasized that their ratings should be an estimate of the expected change (delta) from today and not an estimate of the overall frequency of performance in the future. For example, if a job duty was performed on a frequent basis today and the visionaries expected it would be performed just as frequently in the future, they were to rate it a “3” (no change). An activity rarely performed now and rarely performed in the future would also receive a “3” rating (no change). Further, we then asked visionaries to explain their reasoning for choosing that rating. This allowed for the integration of the visionaries’ quantitative ratings with their qualitative explanations of those ratings.

Change in activity frequency. As before, we analyzed the resulting data in three ways to identify the activities likely to change the most in terms of how often they will be performed in five to seven years. First, we calculated the mean (average) rating, where an average closer to 1 and 2 indicated an activity will be performed less frequently in the future, an average closer to 4 and 5 indicated an activity will be performed more frequently in the future, and an average of about 3 indicated little or no change in how often the activity will be performed in the future. Second, we calculated the percent of respondents indicating that an activity would be performed much more or more frequently in the future. Third, we evaluated the correspondence between the mean rating and percent rating, giving more weight to the percent metric, by rank-ordering the 11 work activities from high to low on the mean and percent rating and cross-plotting the rank orders.

The average ratings of frequency of performing each ORA activity in the future are presented in Table 18, sorted from high to low on the average rating. An average rating higher than about 3.50 indicates that the visionaries indicated that an activity was likely to be performed more frequently in the future. Examining Table 18, visionaries responded that the activities of RISK ANALYSIS, COLLABORATION, COMMUNICATIONS, METHODS AND MODELS DEVELOPMENT, PROGRAM MANAGEMENT, and COST-BENEFIT ANALYSIS were likely to be performed more frequently in the future.

Table 18: Change in frequency of ORA activities as result of eight trends (sorted from high to low)

ORA Activity	Mean	SD	N	% More Frequently	Rank on Mean	Rank on % More Frequently
Risk analysis	4.21	0.89	14	71%	11	10
Collaboration	4.14	0.66	14	86%	10	11
Communications	4.07	0.83	14	71%	9	9
Methods & models development	4.00	0.78	14	71%	8	8
Data management	3.86	1.23	14	57%	7	5
Program management	3.71	0.83	14	64%	6	7
Cost-benefit analysis	3.71	1.07	14	64%	5	6
Research planning	3.50	0.65	14	43%	4	4
Solution development	3.50	0.76	14	36%	3	3
Budgeting	3.00	0.71	13	15%	2	1
Contract management	2.92	0.79	12	17%	1	2

Note: Low average rating (less than about 2.5) indicate an activity will be performed less frequently in the future, a middle rating (around 3) indicates no change in the frequency of performance, and a high average rating (greater than about 3.5) indicates an activity will be performed more frequently in the future.

Qualitative comments from the visionaries and executives corroborated these quantitative findings. Regarding RISK ANALYSIS, one respondent commented, “Instead of analyzing only events, the ORA will need to do risk analysis in real time and on a continuous basis.” Regarding collaboration, another noted that “ORAs are typically thought of as a function that works behind the scenes. Now they are contributing up another level to sharing their analyses resulting in more collaboration among the groups.” Comments were similar for the other job activities respondents rated as becoming more frequent over the next five to seven years. These findings were further substantiated during the executive interviews with comments such as, “The two most critical skills

(ORAs) need are collaboration and communication," and "They have to be able to communicate with the team—they need enough technical understanding to understand the team, and also enough communication skills to explain what they offer."

RESEARCH PLANNING, SOLUTION DEVELOPMENT, BUDGETING, and CONTRACT MANAGEMENT appear likely to be performed about as often as at present (no change). No activity was rated as being performed less frequently in the future. For example, one respondent noted, "The first priority to any analysis effort is planning. I see no change in this…" Regarding the BUDGETING activity, another remarked, "There may be a change in the future for any ORA located within the financial organization, but for the ORAs doing safety data analysis I don't foresee a change." The visionaries made similar comments regarding the other job activities not expected to change.

The proportion of visionaries indicating that an activity would be performed more or much more frequently in the future is also presented in Table 18. Twelve of the 14 visionaries (86%) indicated that Collaboration would be more or much more frequent in the future. Ten of the 14 visionaries (71%) indicated that RISK ANALYSIS and COMMUNICATIONS would be performed more or much more frequently in the future. Nine of the 14 visionaries (64%) indicated that the PROGRAM MANAGEMENT and COST-BENEFIT ANALYSIS activities would be performed more or much more frequently in the future. Eight of the 14 (57%) indicated that DATA MANAGEMENT would be performed more or much more frequently in the future. In contrast, six or fewer of the 14 visionaries (43% or less) indicated that the activities RESEARCH PLANNING, SOLUTION DEVELOPMENT, BUDGETING, and CONTRACTING would be performed more or much more frequently in the future.

We rank-ordered the eleven high-level activities from high to low on the mean rating and percent indicating the activity would be performed more or much more frequently (Table 18). As with the trends analysis, we gave more weight in our interpretation of the results to the percent of visionaries indicating an activity would be performed more or much more frequently in the future than to the average rating. There was little disagreement between the average and percent-based metrics as shown in Figure 4. Taken together, these three analyses (average, percent, and relative rank order) suggest that in the view of the visionaries, activities involving RISK ANALYSIS, COLLABORATION, COMMUNICATIONS, METHODS AND MODELS DEVELOPMENT, DATA MANAGEMENT, PROGRAM MANAGEMENT, and COST-BENEFIT ANALYSIS are likely to be performed more frequently by safety ORAs in future. In contrast, the RESEARCH PLANNING, SOLUTION DEVELOPMENT, BUDGETING, and CONTRACT MANAGEMENT activities are likely to be performed about as often in the future as at present.

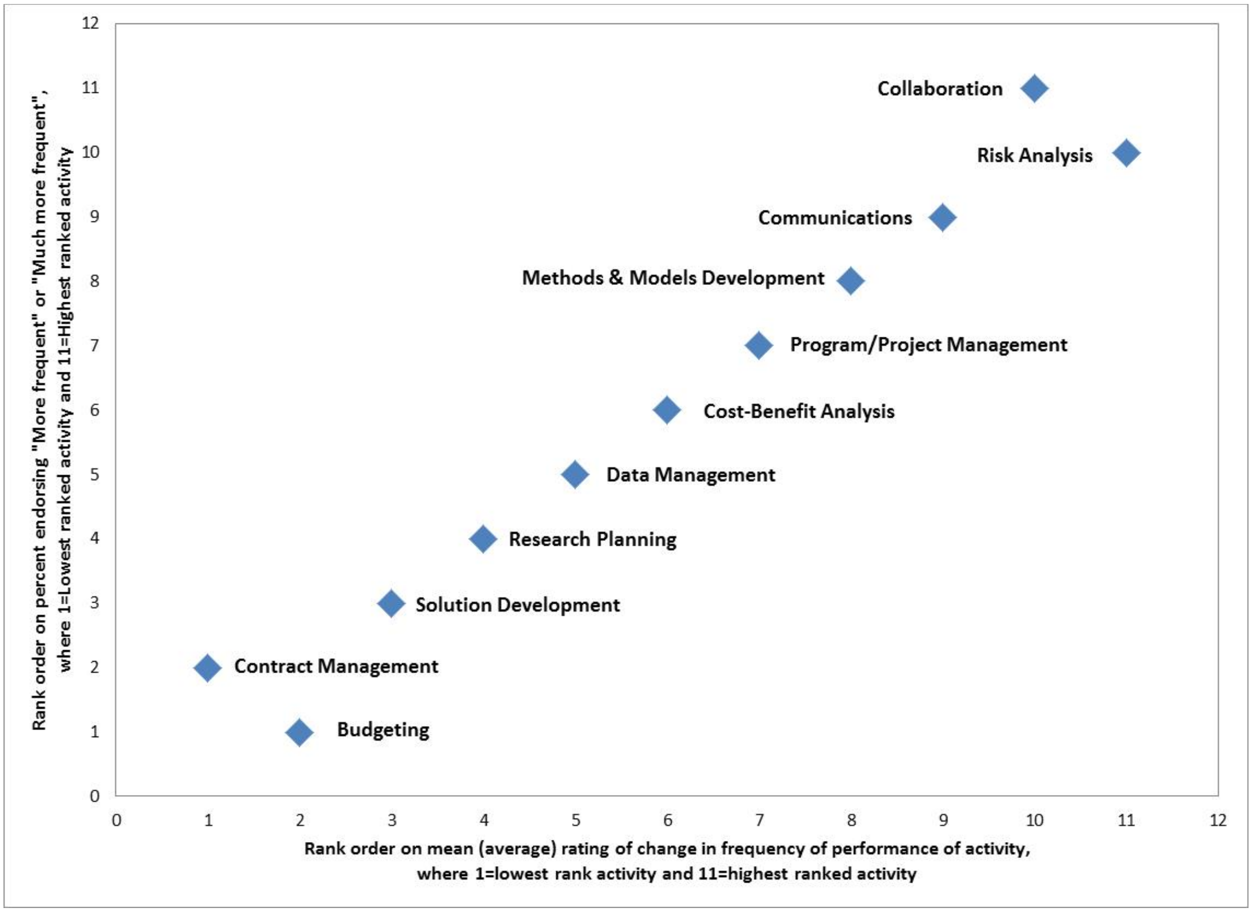

Figure 4: Cross-plot of ORA activities rank-orders based on mean rating of change in frequency of performance and percent indicating activity would be "more" and "much more frequent" in the future

Change in activity importance. The next question is whether the importance of each of the eleven high-level activities will change. Even if an activity is expected to be more frequently performed in the future, it might or might not be more important in the future than it is presently. We asked the visionaries to rate each activity's future importance on a five-point scale, where 1=*Much less important in the future*, 2=*Less important*, 3=*About as important as now (no change)*, 4=*More important*, and 5=*Much more important in the future*. As with the trend impact and future frequency analyses, we examined these importance ratings from three perspectives: the average (mean) rating, the percent of respondents indicating an activity would be "More" or "Much more important," and the agreement between the relative rank orders on the mean and percent metrics for each activity.

The average rating of change in importance of each activity is presented in Table 19. An average between about 3.5 and 5 indicated that the visionaries expected the activity to be more important in the future than at present. An average rating of about 3 (2.5 to 3.5) indicated the visionaries did not indicate any change in the importance of an activity. A low average rating (less than about 2.5) indicated that the visionaries rated an activity as becoming less important in the future than at present.

Table 19: Changes in importance of ORA activities (sorted from high to low)

ORA Job Activity	Mean	SD	N	% More Important	Rank on Mean	Rank on % More Important
Risk analysis	4.36	0.74	14	86%	11	11
Communications	4.07	0.92	14	64%	10	6
Collaboration	4.00	0.68	14	79%	9	10
Methods & models development	3.93	0.73	14	71%	8	8
Data management	3.86	1.03	14	79%	7	9
Program management	3.71	0.73	14	71%	6	7
Solution development	3.64	0.84	14	57%	5	5
Cost-benefit analysis	3.57	1.09	14	50%	4	4
Research planning	3.50	0.76	14	50%	3	3
Budgeting	3.15	0.80	13	31%	2	2
Contract management	2.92	1.00	12	17%	1	1

Note: Low average rating (less than about 2.5) indicate an activity will be less important in the future, a middle rating (around 3) indicates no change in the importance of an activity in the future, and a high average rating (greater than about 3.5) indicates an activity will be more important in the future

Overall, visionaries believed eight of the eleven high-level activities would be more important in the future to safety ORA work than at present. RISK ANALYSIS, COMMUNICATIONS, and COLLABORATION were expected to become even more important in the future than at present. Technical activities such as METHODS AND MODEL DEVELOPMENT, DATA MANAGEMENT, PROGRAM AND PROJECT MANAGEMENT, SOLUTION DEVELOPMENT, and COST-BENEFIT ANALYSIS were also expected to be more important in the future. Again, qualitative comments substantiated these quantitative results. One respondent remarked that “In the future the ORA will need to create predictive models and tools on an ongoing basis.” Another noted that “As we look at new methods and models for analysis of human factors data, solution development becomes more critical.”

The importance of the other three activities—RESEARCH PLANNING, BUDGETING, and CONTRACT MANAGEMENT—were not expected to change in the future. A respondent, explaining his rating of the CONTRACT MANAGEMENT activity, remarked, “I see this the same now as it is in the future. Some ORAs may be involved in this, but the future shouldn't change that.”

The next step was to examine the distribution of importance ratings, where the percent of respondents indicating “More important” and “Much more important in the future” was the focus of the analysis. The results of that analysis are presented in Table 19 as well, along with the rank-orders (from high to low) on the mean rating and percent indicating that the activity would become more or much more important in the future.

Twelve of the 14 (86%) visionaries indicated that the high-level RISK ANALYSIS activity would be more or much more important in the future than at present. Eleven of the 14 (79%) indicated that the COLLABORATION and DATA MANAGEMENT activities would be more or much more important in the future. Ten of the 14 (71%) visionaries indicated that the METHODS AND MODELS

DEVELOPMENT and PROGRAM MANAGEMENT high-level activities would be more or much more important in the future than at present. Just eight of the 14 (57%) respondents indicated that SOLUTION DEVELOPMENT would be more or much more important in the future. Seven or fewer respondents indicated that the high-level COST-BENEFIT ANALYSIS, RESEARCH PLANNING, BUDGETING, and CONTRACT MANAGEMENT activities would be more or much more important in the future. However, three visionaries indicated that the CONTRACT MANAGEMENT activity would be less important in the future for safety ORAs than at present.

The next step in the analysis was to compare the relative rank-orders of the high-level activities based on the average importance rating and the percent marking an activity would be more or much more important in the future than at present. The rank-orders (from high to low) on each metric are presented in Table 19. Those relative rank-orders are plotted in Figure 5. There was little disagreement between the rank-orders or ten of the high-level activities based on the average and percent metrics. The only large disagreement was on the COMMUNICATIONS activity. The COMMUNICATIONS activity was ranked second on the average rating and sixth on the percent marking more or much more important in the future.

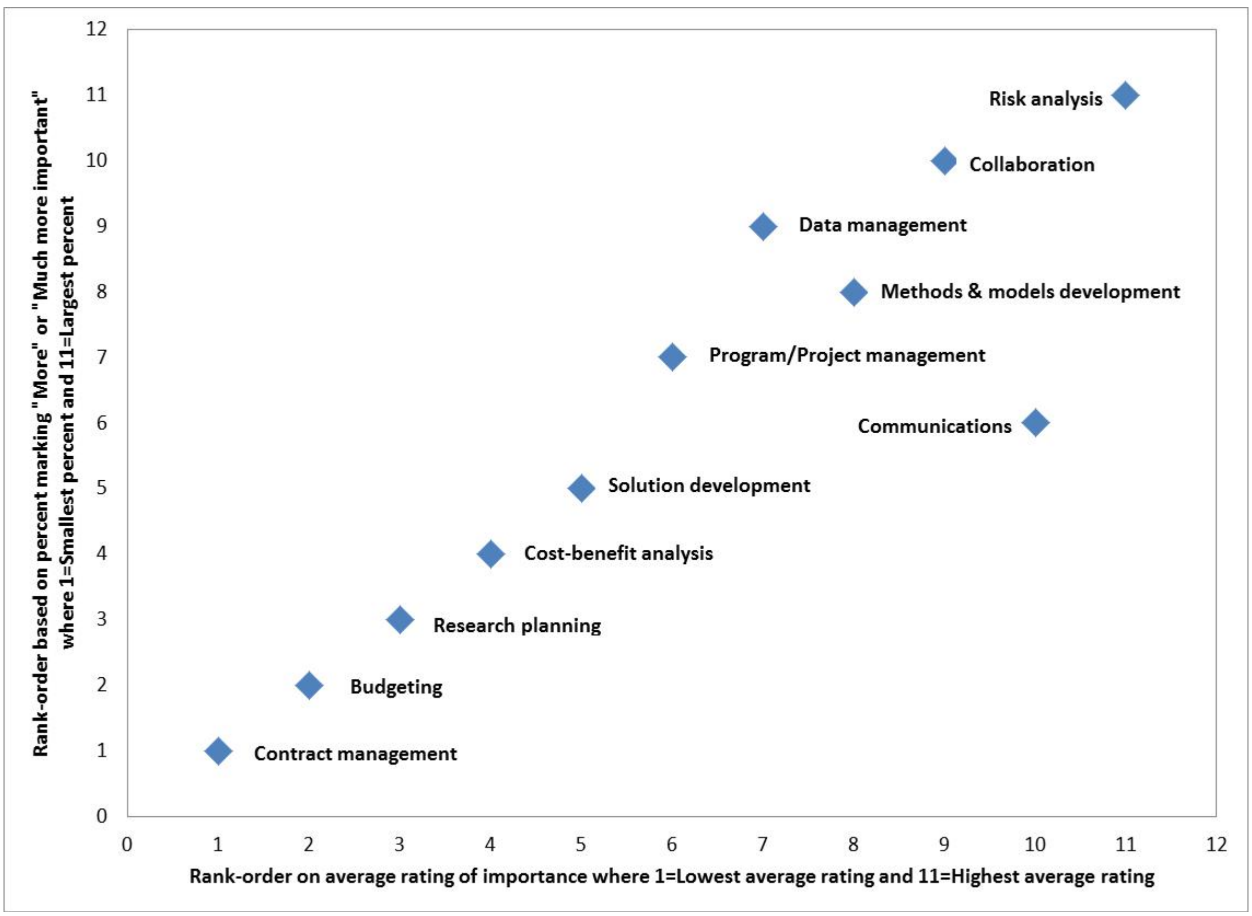

Figure 5: Cross-plot of ORA activities rank-orders based on mean rating of change in importance and percent indicating activity would be "more" and "much more" important in the future

Overall, these three analyses indicate that, according to the visionaries we interviewed, eight of the high-level activities are likely to be more important in the future in the safety ORA community of interest than at present. The high-level activities likely to become more important in the future than at present in safety ORA work are RISK ANALYSIS, COLLABORATION, COMMUNICATIONS, DATA MANAGEMENT, METHODS AND MODELS DEVELOPMENT, PROGRAM MANAGEMENT, SOLUTION DEVELOPMENT, and COST-BENEFIT ANALYSIS. The importance of the other three high-level activities—RESEARCH PLANNING, BUDGETING, and CONTRACT MANAGEMENT—will likely remain about the same as at present. Importantly, overall, no high-level activity appears likely to be less important to Safety ORA work in the future.

Trend impact on ORA competencies

Trend impact overall. The previous analyses focused on assessment of the impact of the eight trends on the work activities performed by ORAs. The next step in the analysis was to investigate the impact of these trends and changes in the work on the competencies (KSAs) required of safety ORAs.

We followed the same steps in the competencies analysis as in the activities analysis. First, based on the visionary interviews, we examined the likely impact of the eight trends on the overall competencies. The stimulus question in the interview was what impact would a trend have on ORA competencies overall, where the visionary rated the impact on a scale where 1=*No impact at all on ORA competencies*, 2=*Very little impact*, 3=*Moderate impact*, 4=*Substantial impact*, and 5=*Very great impact on ORA competencies*. As in the previous analyses, we examined the average rating across visionaries, the percent of visionaries indicating substantial or very great impact of a trend on overall competencies, and the agreement between these two metrics via a cross-plot of the competencies rank-orders. From this analysis, we identified the trends likely to have the greatest impact on ORA competencies.

The average impact of each trend on ORA competencies overall is presented by trend in Table 20. The trends are sorted from high to low mean (average) impact in the table. Average ratings of 3.5 or higher suggested greater impact, while ratings of about 2.5 or lower suggested little to no impact from a trend on ORA competencies. Average ratings in the 2.5 to 3.5 range suggested a moderate impact on ORA competencies.

Table 20: Average impact on ORA competencies by trend (sorted high to low mean impact)

Trend	Mean	SD	N	% High Impact	Rank on Mean	Rank on % High Impact
Shift from reactive to proactive oversight	3.79	1.05	14	64%	8	8
Big Data	3.69	0.94	13	54%	7	7
NextGen implementation	3.50	1.24	12	42%	6	4
Advances in mathematical modeling	3.43	0.85	14	50%	5	6
UAS integration into NAS	3.38	1.12	13	38%	5	3
FAA regulatory oversight role change	3.23	1.17	13	46%	3	5
CSO integration into NAS	2.92	1.04	13	15%	2	2
Cockpit automation	2.79	0.98	14	14%	1	1

Overall, the shift from reactive to proactive oversight appears likely to have the largest impact. However, with an average rating of 3.79, the degree of impact is in the moderate-to-substantial range. "Big Data" followed a similar pattern, with an average rating of 3.69, suggesting a moderate to substantial impact on ORA competencies. The other six trends appear likely to have only moderate impact, on average, on the competencies required of ORAs in the aviation safety community of interest.

Examination of the distribution of ratings by trend reinforces this interpretation with the percent of respondents indicating that a trend would have "substantial" or "very great" impact on the competencies required of ORAs (Table 20). For example, just nine of 14 (64%) indicated that the shift from reactive to proactive oversight would have "substantial" or "very great" impact on the competencies required of safety ORAs. Just seven of 13 visionaries indicated that "Big Data" would have substantial or very great impact on ORA competencies. Lower ratings—moderate and little impact—were given by the visionaries on the other trends. For example, seven of 13 visionaries (54%) responding indicated that changes in the FAA regulatory oversight role would have moderate to little impact on safety ORA competencies over the next five to seven years.

Comparison of the relative rank-orders indicated that there was substantial agreement between the two metrics for evaluating the impact of the trends on the overall competencies required of safety ORAs (Figure 6). Overall, whether based on average rating of the impact of a given trend on safety ORA competencies or based on the percent of visionaries indicating that a trend will have substantial or very great impact on ORA competencies, it appears that the eight major trends considered will have a moderate impact overall on ORA competencies.

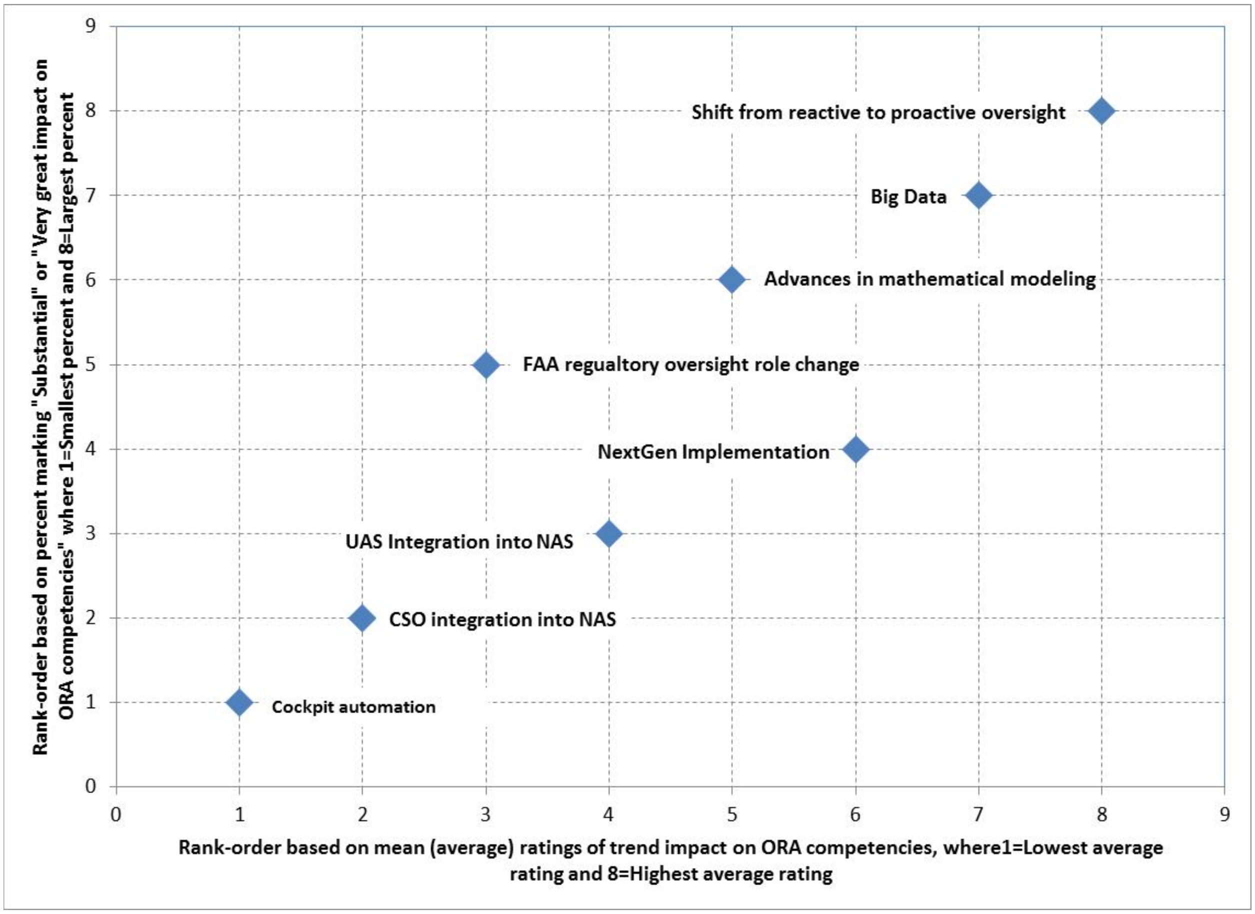

Figure 6: Cross-plot of rank orders of eight trend impact on ORA competencies based on mean impact rating and percent indicating "substantial" or "very great" impact

Comments received from visionaries substantiated these quantitative findings. One commented regarding the shift to proactive analysis that "The industry has to provide us data and it isn't being collected. If we can get the data, we have to have ways to do data mining. This is going to change the requirements of the people and technology—but that is not available yet." Another commented on "Big Data" that "[Big Data] is about harnessing the power of things like social data and the new ways to gain data. For example, a flight may hit some rough air…[With] inflight Wi-Fi, the passengers themselves instantly may tweet or post that bump or rough ride, providing the agency a new data stream that we did not have available before. We can now grab those new data sources. The challenge will be both getting and analyzing that data."

Specific competencies. In the "as is" baseline job analysis, we identified 16 high-level competencies required of ORAs (Table 10). In the "to be" phase of the overall strategic job analysis, we asked the visionaries how the importance of each of these 16 competencies would change over the next five to seven years, given the trends and changes in the work discussed previously. Visionaries were asked to respond using a scale in which 1=*Much less important in the future*, 2=*Less important*, 3=*About the same importance (no change)*, 4=*More important*, and 5=*Much more important in the future*. As in the previous analysis on job activities, we stressed that visionaries should comment regarding any change they expected in the need for that competency, not an overall rating of importance. We also used the same analysis procedure as in the previous analyses, examining the mean (average) ratings, the percent of visionaries indicating that a competency would be "more" or "much more important" in the future, and the degree of agreement between those two metrics based on rank-orders. Based on those analyses, we identified the competencies that were likely to be more important in the future to safety ORA work than at present.

Average ratings of change in importance of each of the 16 ORA high-level competencies are presented in Table 21. An average rating of about 3.5 or higher suggests that a competency will be more important in the future than at present. An average rating of about 2.5 to 3.5 suggests no change in the importance of a specific competency. An average rating of less than about 2.5 suggests the competency will be less important in the future to ORA work than at present.

Table 21: Change in importance of ORA competencies in future (sorted from high to low on mean)

Competency	Mean[1]	SD	N	% More Important[2]	Rank on Mean	Rank on % More Important
Risk & Hazard Analysis Skills	4.21	0.80	14	79%	16	15
Data Analysis Skills	4.14	0.66	14	86%	15	16
Mathematical Knowledge	3.93	0.62	14	79%	14	14
Deductive Reasoning Abilities	3.93	0.73	14	71%	13	13
Aviation Industry Knowledge	3.93	0.73	14	50%	12	6
Interpersonal Relations Abilities	3.93	1.00	14	71%	11	12
Inductive Reasoning Abilities	3.86	0.86	14	71%	10	11
Aviation System Safety Knowledge	3.86	0.86	14	57%	9	9
Decision Support Systems Knowledge	3.79	0.89	14	64%	8	10
Operations Research Core Technical Knowledge	3.71	0.73	14	57%	7	8
Systems Analysis Knowledge	3.71	0.83	14	50%	6	5
FAA Knowledge	3.64	0.633	14	57%	5	7
Persistence Ability	3.50	0.76	14	36%	4	4
Program-Project Management Skills	3.29	0.61	14	36%	3	3
Office Automation Skills	3.21	0.80	14	14%	2	2
Procurement Knowledge	2.79	1.12	14	14%	1	1

Note: [1]Lower mean ratings (of about 2.5 or less) indicate a competency will be less important in the future, average ratings in the middle (around 3) indicate no change in importance, and higher mean ratings (about 3.5 or greater) indicate a competency will be more important in the future
[2]% More important is proportion of respondents indicating competency would be "more" or "much more" important in the future

Using this interpretive heuristic, 12 of the 16 ORA competencies (75%) will be more important to ORA work in the future than at present, and the remaining four will be about as important in the future as at present. The importance of *Risk and Hazard Analysis Skills* and *Data Analysis Skills* in particular seem likely to be more important in the future based on visionary ratings. *Mathematical Knowledge*, *Deductive Reasoning Abilities*, and *Aviation Industry Knowledge* are also likely to be more important in the future. Interestingly, these are all technically-oriented competencies. However, *Interpersonal Relations Ability*, a "soft" or non-technical competency, will also be more important in the future than at present, based on visionary ratings.

Examination of the distribution of ratings by competency provided additional context for interpreting the mean ratings. The percent of respondents indicating that a high-level competency would be more or much more important in the future is also presented in Table 21. For example, 12 of the 14 (86%) visionaries indicated that *Data Analysis Skills* would be "more" or "much more" important in the future than at present. As a result, this competency ranked first, based on the percent of raters marking "More" or "Much more important." But of those 12, just four indicated that the competency would be much more important. In contrast, 11 of the 14 visionaries (79%) indicated that *Risk and Hazard Analysis Skills* would be more or much more important in the future. Of those 11 visionaries, six indicated that *Risk and Hazard Analysis Skills* would be much more important in the future, resulting in an overall higher average rating for this competency.

As in the previous analyses, we rank-ordered (from high to low) the competencies on the mean rating and percent indicating a competency would be more or much more important in the future as shown in Table 21. As a consequence of these differences, the relative rank-ordering of to what degree the importance of specific competencies will change will vary on these two metrics, as shown in Figure 7. The only major disagreement between the two metrics was for *Interpersonal Relations Abilities*. Rank-ordered on mean (average) rating, this competency was ranked fifth. However, when rank-ordered based on the percent of visionaries indicating it would be more or much more important in the future, it was ranked eleventh. Seven of 14 visionaries (50%) indicated that *Interpersonal Relations Abilities* would be about as important in the future as at present, six marked "Much more important in the future," and one visionary indicated it would be "More important" in the future than at present. Essentially, there was a 50/50 split in the visionaries as to whether *Interpersonal Relations Abilities* would be more important in the future or about the same importance as at present.

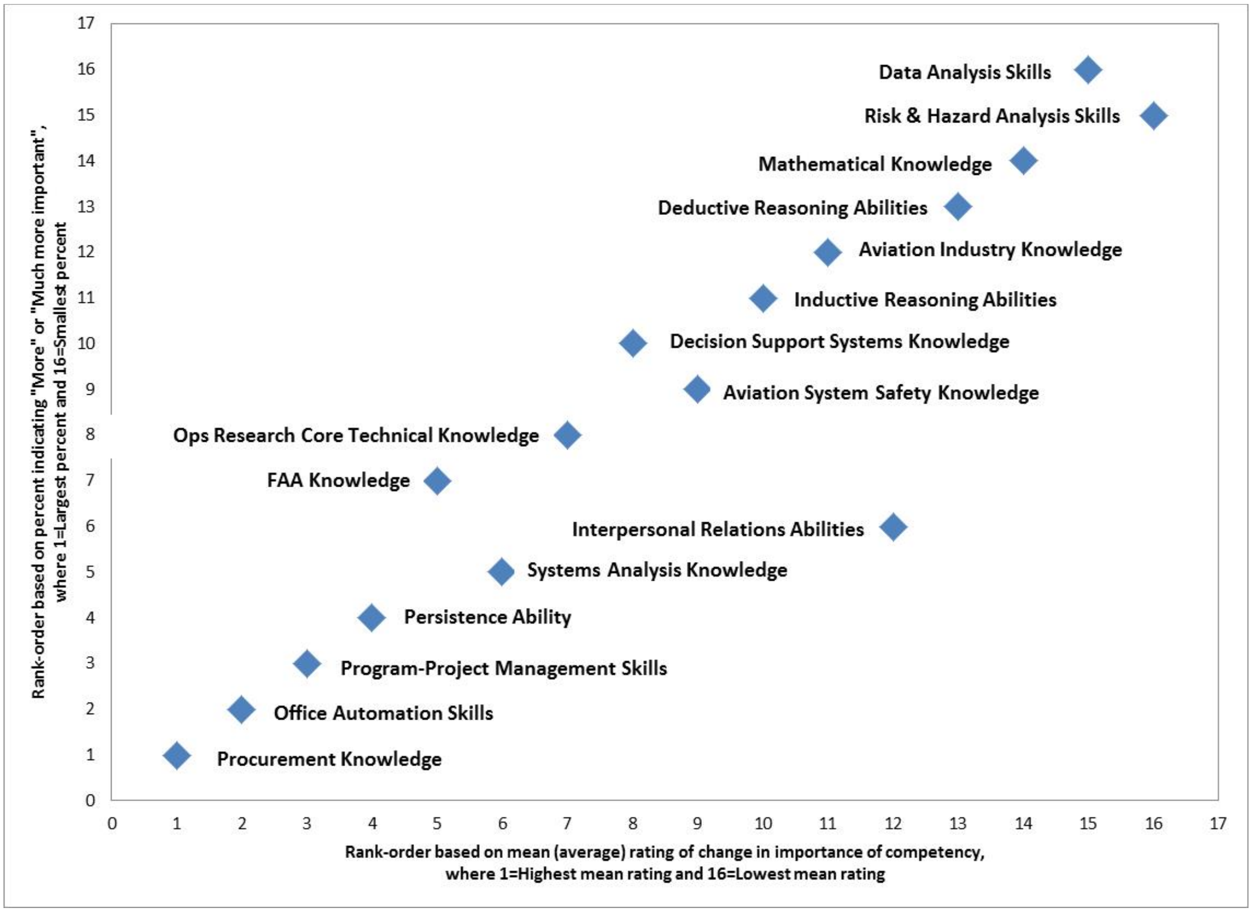

Figure 7: Cross-plot of rank-order of ORA competencies based on mean rating of change in importance of competency and percent indicating competency would be "more" and "much more important" in the future

Comments from the visionaries corroborate this split. Examples of the two extremes ranged from, "Part of the job now," on the low end to, "The agency needs cross-organizational communication based on persuasive documentation. Interpersonal relations is critical to achieving that," on the high end of the spectrum.

In contrast, the overall pattern of changes in the importance for the other 15 competencies was reasonably consistent across the two metrics. Technical competencies such as *Risk and Hazard Analysis Skills*, *Data Analysis Skills*, *Mathematical Knowledge*, *Deductive and Inductive Reasoning Abilities*, and *Aviation Industry Knowledge* and *Aviation System Safety Knowledge* are likely to be more important over the next five to seven years to the work of ORAs in the aviation safety community of interest than at present.

New or additional job activities

The visionaries were given the opportunity to identify any new or additional activities that will be performed by ORAs in five to seven years from now. For each statement provided, we then subjectively evaluated that job duty and determined whether we believed it represented a new duty for the ORA or was an aspect of a job duty already defined through previous analysis processes.

Seven of the 14 (50%) visionaries responded "None" to the question regarding additional job activities. One visionary highlighted the need for ORAs to not just present data, but also their recommendations. We believe presentation of data and recommendations were covered in the COMMUNICATIONS and SOLUTION DEVELOPMENT activities. Another visionary mentioned simulation modeling, which is covered by the broad MODELS AND METHODS DEVELOPMENT activity. A different visionary mentioned information technology (IT) system oversight, technical testimony, optimization, and spatial analysis. Database design, development, and administration and data source management were also suggested by the visionaries. We believe these activities are encompassed by the DATA MANAGEMENT activity. Another visionary mentioned the ORA's role in writing policy, pointing to a systematic lack of understanding in the ORA community about the process for policy (including regulations and advisories) writing in the FAA. This aspect can be viewed as part of the COMMUNICATIONS and SOLUTION DEVELOPMENT activities. International collaboration was mentioned by another visionary, which fits with the COLLABORATION activity. Other comments by the visionaries related more to the role and utilization of ORAs rather than new or additional activities. Based on this analysis, we concluded that no new activities were added to the catalog of high-level activity statements based on the visionary interviews.

New or additional competencies

Visionaries also were given the opportunity to identify any new or additional competencies that would be relevant to the ORA job in five to seven years. As with the job activities, we then categorized these responses into existing competencies or new competencies.

Eight of the 14 visionaries responded "None." One visionary mentioned Geographic Information System (GIS) analyses. This is a specific competency that can be nested under the high-level *DECISION SUPPORT SYSTEM KNOWLEDGE* competency. Spatial analysis and optimization were also suggested as new aspects of the ORA job by visionaries. In our view, these are both techniques encompassed by *OPERATIONS RESEARCH CORE TECHNICAL KNOWLEDGE* competency (courses in "optimization" are specifically required in OR graduate studies, for example). A perceived lack of knowledge about the FAA policy process is encompassed by the *FAA KNOWLEDGE* competency. Another mentioned knowledge of the FAA Acquisition Management System (AMS), which is a specific topic within the *FAA KNOWLEDGE* competency. Other visionary remarks related to the organizational role of ORAs rather than new or additional competencies. Overall, we concluded that no additional or new competencies were elicited for inclusion in the "to be" profile of the ORA occupation.

"To Be" Safety ORA job description

Based on the visionary interviews, we concluded that the work performed by, and competencies required of, safety ORAs will not dramatically change over the next five to seven years. Essentially, the job description developed in the "as is" phase of analysis will suffice for the "to be" job description. However, there will be shifts in importance of activities and competencies in the five to seven year range this study focused upon. Those shifts are reflected in the ordering of the job activities and competencies in Table 22. This issue is explored in greater depth in the gap analysis.

Table 22: "To Be" ORA job description

Safety ORA Activities	All ORA Activities (Core)	Other ORA Activities
Risk Analysis		
	Collaboration	
	Communications	
	Models & Methods Development	
	Data Management	
	Program/Project Management	
		Cost-Benefit Analyses
	Research Planning	
	Solution Development	
		Budgeting
		Contract Management

Safety ORA Competencies	Core ORA Competencies	Other ORA Competencies
Risk & Hazard Analysis Skills		
	Data Analysis Skills	
	Mathematical Knowledge	
	Deductive Reasoning Abilities	
Aviation Industry Knowledge		
	Interpersonal Relations Abilities	
	Inductive Reasoning Abilities	
Aviation System Safety Knowledge		
	DSS Knowledge	
	Operations Research Core Technical Knowledge	
	Systems Analysis Knowledge	
	FAA Knowledge	
	Persistence Ability	
	Program & Project Management Skills	
	Office Automation Skills	
		Procurement Knowledge

SECTION 4: GAP ANALYSIS

A key feature of the strategic job analysis process is the analysis of the gap between "as is" and "to be." Any gaps due to changes in importance or frequency of activities in the job or importance of broad competencies will have to be addressed through recruitment, training, or other organizational intervention. To identify these gaps, the first step is to compare the "as is" and "to be" activity data. The second step in the gap analysis is to compare the "as is" and "to be" competency profiles.

Activity importance

In the "as is" phase of the strategic job analysis process, incumbent ORAs were asked to rate the importance of the intermediate level job duties on a 1 to 5 scale, where 1=*Not at all important* and 5=*Extremely important*. We then aggregated the ratings of these job duties upwards to calculate the importance of the parent activity. The average activity importance ratings for incumbent safety ORAs is presented in Table 23 in the column labeled "As Is Mean."

Table 23: Comparison of "as is" and "to be" (change) in activity importance

	As Is		**To Be**[2]		
Activity[1]	*M*	*SD*	*M*	*SD*	**Interpretation**
Contract Management	1.94	1.20	2.92	1.00	About the same importance
Budgeting	2.39	1.29	3.15	0.80	About the same importance
Cost-Benefit Analysis	2.55	1.20	3.57	1.09	Slightly more important
Collaboration	3.22	1.13	4.00	0.68	More important
Communications	3.45	1.02	4.07	0.92	More important
Program Management	3.51	1.28	3.71	0.73	More important
Methods & Models Development	3.88	1.13	3.93	0.73	More important
Solution Development	3.90	1.12	3.64	0.84	Slightly more important
Risk Analysis	3.91	1.03	4.36	0.74	More important
Data Management	3.98	0.94	3.86	1.03	More important
Research Planning	4.01	0.80	3.50	0.76	About the same importance

Notes: [1]Activities sorted on "As Is" importance.
[2]"To Be" scale 1=*Much less important*, 2=*Less important*, 3=*About the same*, 4=*More Important*, 5=*Much more important*

In the "to be" phase of the strategic job analysis process, key respondents (termed "visionaries"—supervisors and managers in the safety community of interest) were asked to rate to what degree the importance of these high-level activities would change in the future on a scale where 1=*Much less important*, 3=*About the same* (importance), and 5=*Much more important* (in the future). An average rating of about 3 (approximately 2.5 to 3.5) indicated that the importance of an activity was expected to be about the same in the future as now. An average rating towards the higher end (3.5 to 5) indicated an activity was expected to become more important to ORA work, while an average rating at the lower end (2.5 to 1) indicated an activity was expected by the visionaries to become less important in the future. Ratings provided by the visionaries are qualitative in nature, suggesting the direction and rough magnitude of change in the importance of a Safety ORA major job activity. The average rating from visionaries of the expected change in the importance of each high-level activity is presented in Table 23 in the column labeled "To Be Mean Change." The last column in Table 23 presents our assessment of the resulting gap in terms of the expected change in importance of an activity.

Based on this heuristic, visionaries rated six of the high-level ORA activities as becoming more important in the future than at present: PROGRAM MANAGEMENT; DATA MANAGEMENT; METHODS & MODEL DEVELOPMENT; COLLABORATION; COMMUNICATIONS; and RISK ANALYSIS. In particular, as shown in Figure 8, COLLABORATION, COMMUNICATIONS, and RISK ANALYSIS are activities that are likely to become even more important to ORA work in the future than they already are. Visionary ratings of COST-BENEFIT ANALYSIS and SOLUTION DEVELOPMENT suggested that these activities might increase slightly in importance. However, it is important to note that COST-BENEFIT ANALYSIS was rated, on average, in the lower end of the "As Is" importance scale (*Mean* = 2.55 on 5-point scale), while RESEARCH PLANNING was rated, on average, as the most important "As Is" activity (*Mean* = 4.01).

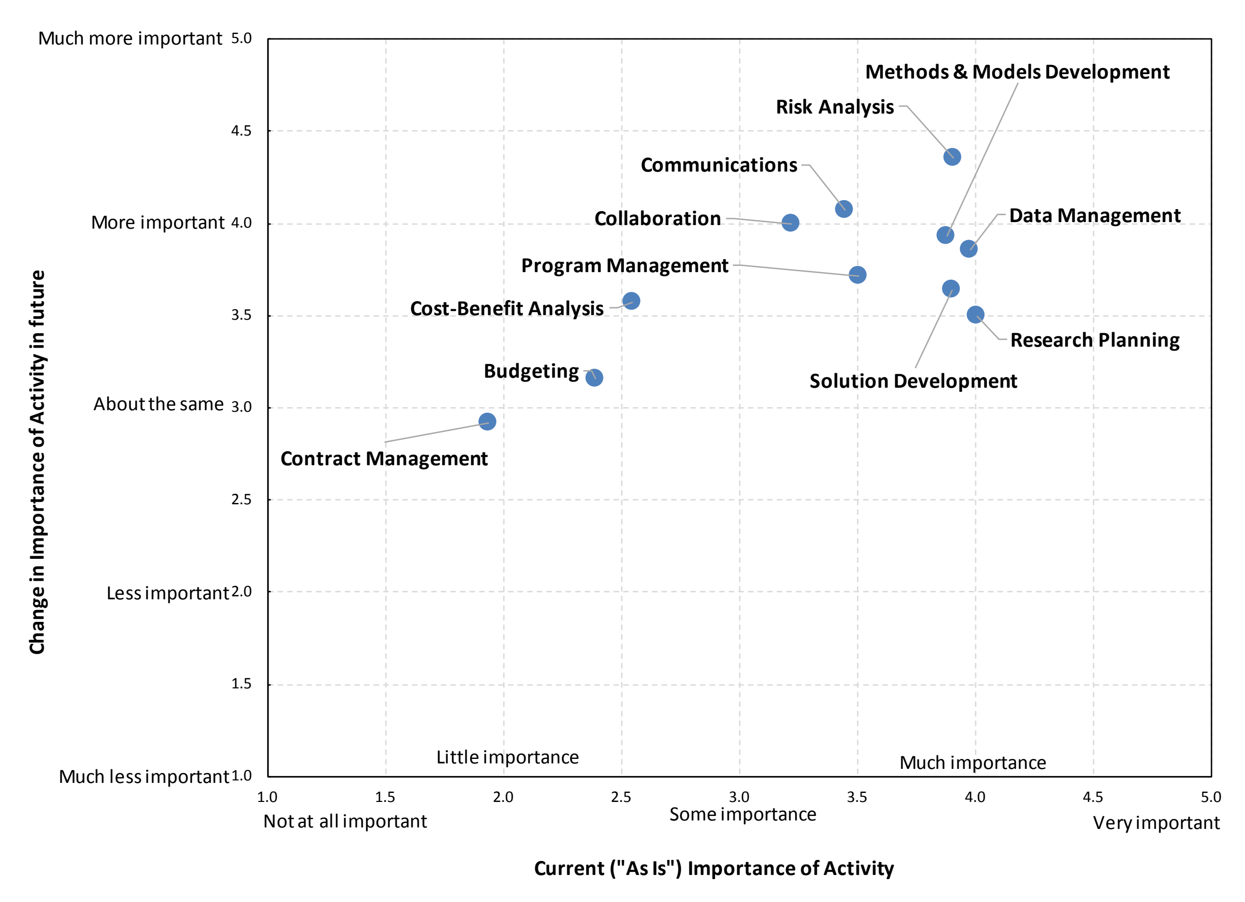

Figure 8: Comparison of "as is" and "to be" (change in) activity importance

Qualitative comments from both visionaries and executives corroborated these findings. Examples from visionaries include, “This is going to increase in importance—ORAs will be working with cross-organizational, cross-agency (DOD, DHS, etc.), and cross-industry teams. In the future teams will cross all traditional boundaries,” and, “New tools and initiatives like NextGen and the agency's changing regulatory role are driving the importance of this higher—if we don’t get stakeholder participation through collaboration, it will result in poor work on our part.”

The relationship between “as is” and “to be” are presented graphically in Figure 8. It is clear from the figure that RISK ANALYSIS, COMMUNICATIONS, and COLLABORATION, will be more important in the future than at present. It is also clear that the importance of CONTRACT MANAGEMENT and BUDGETING activities will remain about the same in the future. The importance of the COST-BENEFIT ANALYSIS activity is likely to increase slightly in the future, based on visionary ratings. However, as one visionary noted that, “{ORAs} don’t need to be an expert in this area, but we should be introduced and familiar with it when the others on the team discuss it.” The SOLUTION DEVELOPMENT activity follows a similar pattern with visionaries expecting that activity to become slightly more important to the Safety ORA job in the future. As noted above, RESEARCH PLANNING was the most highly rated of the activities and is likely to continue to be an even more important activity for Safety ORAs in five to seven years.

Activity frequency

The comparison of incumbent mean ratings of high-level activity frequency with visionary ratings of the frequency of those activities in the future is presented in Table 24. From the perspective of the visionaries, the frequency of performing the BUDGETING and CONTRACT MANAGEMENT activities appears unlikely to change in the next five to seven years (Figure 9). It also appears the COST-BENEFIT ANALYSIS will be performed slightly more often in the future. However, all three of these high-level activities are not performed less often relative to the other activities. The other 8 activities do appear likely to be performed somewhat more often in the future than at present, from the perspective of the visionaries. In other words, they are frequently performed now, and will be performed somewhat more frequently in the future. The fact that eight of eleven high-level activities are likely to be performed more frequently in the future suggests that the visionaries are expecting an increase in the velocity and/or volume of analyses performed by ORAs in the aviation safety community of interest. This might also reflect an increased emphasis in the agency on risk-based decision making in which empirical data and analyses play an important role.

Table 24: Comparison of "as is" and "to be" (change) activity frequency

Activity[1]	As Is *M*	As Is *SD*	To Be[2] *M*	To Be[2] *SD*	Interpretation
Contract Management	1.71	1.07	2.92	0.79	About the same
Cost-Benefit Analysis	2.00	0.95	3.71	1.07	More frequent
Budgeting	2.21	1.10	3.00	0.71	About the same
Methods & Models Development	3.04	1.17	4.00	0.78	More frequent
Program Management	3.06	1.19	3.71	0.83	More frequent
Collaboration	3.15	1.01	4.14	0.66	More frequent
Solution Development	3.35	1.14	3.50	0.76	Slightly more frequent
Data Management	3.48	0.95	3.86	1.23	More frequent
Risk Analysis	3.54	1.08	4.21	0.89	More frequent
Communications	3.68	1.04	4.07	0.83	More frequent
Research Planning	3.87	0.84	3.50	0.65	Slightly more frequent

Notes: [1]Activity sorted on "As Is" frequency rating.
[2]"To Be" scale 1=*Much less frequent*, 2=*Less frequent*, 3=*About the same*, 4=*More frequent*, 5=*Much more frequent*

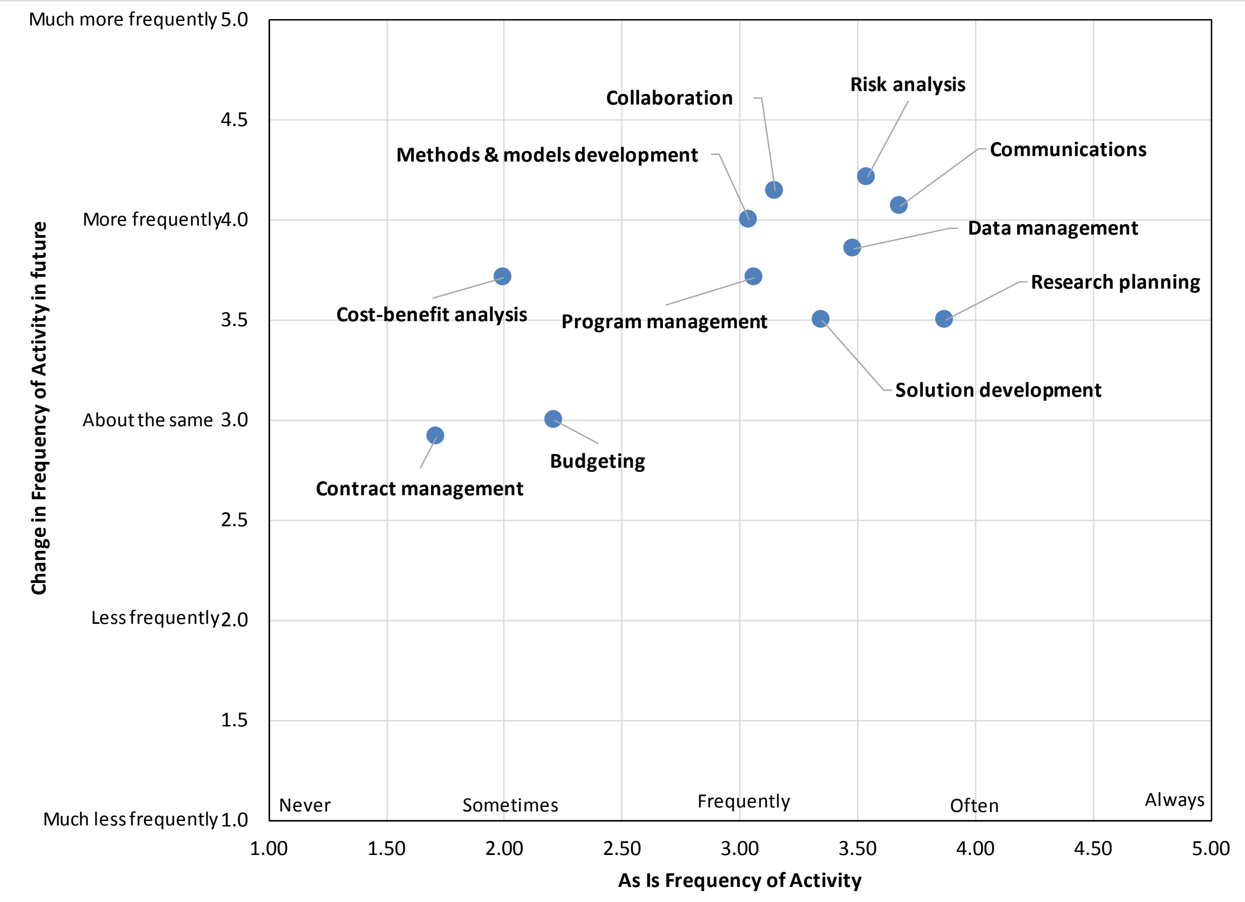

Figure 9: Comparison of "as is" and "to be" (change in) activity frequency

Competencies

As in the analyses of activities, we compared the "as is" ratings of importance of the 16 high-level competencies to the "to be" ratings from visionaries to examine the gap between the current and future (Table 25). The importance of three high-level competencies were not predicted to change over the next five to seven years by the visionaries: *PROCUREMENT KNOWLEDGE*; *PROGRAM & PROJECT MANAGEMENT SKILLS*; and *AVIATION INDUSTRY KNOWLEDGE* (Figure 10). All three competencies have some importance to the job and appear likely to continue to be somewhat important in the future. In contrast, the other thirteen competencies appear likely to become more important in the future. The likely increase in importance was slight for *DECISION SUPPORT SYSTEMS KNOWLEDGE*, *FAA KNOWLEDGE*, *SYSTEMS ANALYSIS KNOWLEDGE*, and *OPERATIONS RESEARCH (OR) CORE TECHNICAL KNOWLEDGE*. These competencies are currently somewhat important to the Safety ORA job, and will become slightly more important in the future in a relative sense. A sample comment from a visionary regarding *FAA KNOWLEDGE* reflects this change: "Many ORAs don't understand how a regulator such as the FAA works, or how we interact with industry, and {ORAs} need to in order to complete their analysis and develop solutions properly."

Table 25: Comparison of "As Is" and "To Be" (change in) competency importance

	As Is		To Be[2]		
Activity[1]	*M*	*SD*	*M*	*SD*	**Interpretation**
Procurement Knowledge	2.25	0.93	2.79	1.12	About the same
Program & Project Management Skills	3.08	0.78	3.21	0.80	About the same
Aviation Industry Knowledge	3.08	1.14	3.29	0.61	About the same
Decision Support Systems Knowledge	3.30	1.03	3.50	0.76	Slightly more important
FAA Knowledge	3.40	1.07	3.64	0.63	Slightly more important
Systems Analysis Knowledge	3.68	1.02	3.71	0.83	Slightly more important
OR Core Technical Knowledge	3.82	0.95	3.71	0.73	Slightly more important
Mathematical Knowledge	3.90	0.89	3.79	0.89	More important
Interpersonal Relations Abilities	4.03	0.72	3.86	0.86	More important
Risk & Hazard Analysis Skills	4.08	0.89	3.86	0.86	More important
Data Analysis Skills	4.10	0.77	3.93	0.73	More important
Aviation System Safety Knowledge	4.15	0.79	3.93	1.00	More important
Persistence Ability	4.26	0.87	3.93	0.73	More important
Office Automation Skills	4.39	0.68	3.93	0.62	More important
Inductive Reasoning Abilities	4.39	0.64	4.14	0.66	More important
Deductive Reasoning Abilities	4.43	0.63	4.21	0.80	More important

Notes: [1]Activity sorted on "As Is" importance
[2]"To Be" scale 1=*Much less important*, 2=*Less important*, 3=*About the same*, 4=*More important*, 5=*Much more important*

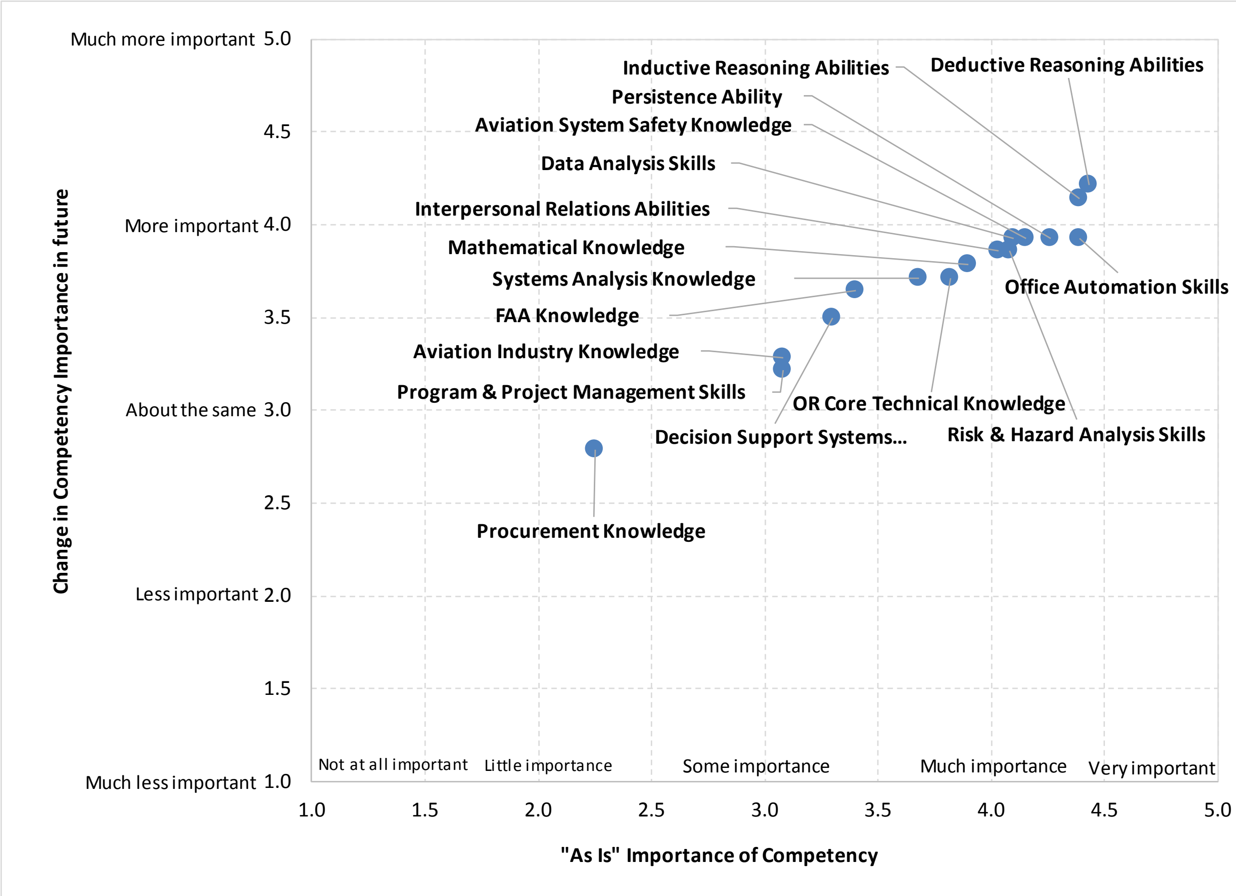

Figure 10: Comparison of "as is" and "to be" (change in) competency importance

The remaining competencies, in contrast, are more important (relative to the other competencies) to the Safety ORA job now, and will become even more important to the job in the future. This tracks with the increase in the velocity and volume of analyses likely to be required in the future as previously discussed. That is, as more technical analyses are required, with likely increased complexity, core technical competencies will become increasingly important in that work over the next five to seven years.

SECTION 5: CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Overall, the ORA job in the aviation safety community of interest in about five to seven years will be very similar to the ORA job as it is performed at present in terms of high-level activities performed and competencies required to perform those activities.

The analysis of risk, internal and external collaboration, communication of technical analyses and recommendations, and the use of increasingly sophisticated methods and models with ever-larger and more complex data will continue to be important ORA activities.

What might change is the velocity and volume of these types of analyses that will be conducted in the future, based on the likely increase in frequency of performance we observed in the data collected from ORA supervisors and program managers. Generally, an increase in the frequency of activities suggests a greater volume of work can be anticipated, but this should be empirically evaluated over the next few years. This strategic analysis did not explore the technical characteristics of risk and hazard analyses likely to be performed in the future. The complexity and scope of future risk and hazard analyses should also be monitored in terms of changes in competency requirements.

It appears as well that in the future ORAs will engage in substantive internal and external collaborations. This implies that "soft" other than technical skills related to interpersonal relations will be continue to be important, as borne out by the comparison of "as is" and "to be" competencies data. As one executive stated, "The ORA has got to be able to work in the team to show relevancy of their skills and what they can provide."

From a competency perspective, this strategic job analysis did not point to any major shifts in the profile of competencies required of safety ORAs. That is, no competencies were perceived as being less important in the future. Generally, our conclusion is that, basically, "more of" any given competency will be required for Safety ORAs. An interesting aspect of the competencies profile is the need for the ability to persist on a task. ORA work is complex, and as in any scientific undertaking, there are likely to be dead-ends, rejected hypotheses, and failed models along the way towards a workable, interpretable, and useful analysis and recommendation. Persistence in the face of such obstacles will continue to be an important attribute of ORAs.

Recommendations

Our first recommendation concerns the COLLABORATION high-level activity. We strongly recommend identifying and cataloging internal and external points of collaboration that are required at present. For example,

- On what cross-organizational teams do current ORAs work, and on what projects or tasks are these teams assigned?
- What is the initiating requirement for the projects or tasks?
- What roles do different ORAs fulfill or take on in those projects or tasks?
- What is their scope of authority in those teams?
- On what projects or tasks are ORAs working alone, or very nearly so?

Answering these and similar questions could start with an inventory of projects and tasks currently assigned to safety ORAs along with team information. Tools such as network analysis could be used to map the points of collaboration and networks of ORAs with projects and tasks in common. Given that COLLABORATION will increase in importance and frequency, this is a high priority recommendation.

Our second recommendation concerns the COMMUNICATIONS activity. The starting point, as with COLLABORATION, is constructing an inventory of types of communications and settings as well as future demands in terms of types of communications and settings. For example,

- What proportion of ORA communications is given over to briefings of technical analyses to management and executive audiences?
- What proportion of ORA communications are presented at technical conferences?
- What is the extent and role of peer-to-peer communications?
- How much is oral and how much is written?

It is very important, in our opinion, to better understand the communications demands placed on ORAs before recommending training, coaching, or other skills development.

Our third recommendation is to consider building a dynamic database of ORA analysis assignments as the basis for a catalog of the knowledge and skills of current ORAs. This type of technology is commercially available and used by many high-technology corporations such as Oracle, Amazon, and Google. Enterprise-level resource planning software suites such as Oracle Human Capital Management® and the Microsoft Dynamics AX® suite have these capabilities. For example, Oracle provides a software tool named Employee Experience Journey Mapping (EXJM®) to elicit and capture employee experiences, skills, and knowledge for future reference and potential work assignments.

Our fourth recommendation focuses on development of assessments of the competency of individual ORAs. We do <u>not</u> recommend this as an immediate course of action following this strategic job analysis. Here is our reasoning. First, development of reliable and valid assessments of any technical occupation, especially one as technical as operations research, is labor intensive and very expensive. With less than 200 persons in the occupation agency-wide, it is not clear that there would be a substantial return-on-investment for such assessments. Second, quite frankly such individual assessments are likely to be perceived as threatening by employees and their collective bargaining agents, particularly with respect to how the resulting data on a specific person might be used by management. Third, it is tempting to substitute competency assessment for performance assessment by management; we recommend avoiding that trap by not developing individual assessments of ORA competency outside the FAA-wide framework for valuing performance.

Our fifth recommendation focuses on improvement and standardization of ORA job documentation. As noted in *Section 2: "As-Is" Job Analysis* of this report, our research identified 28 separate JATs for the ORA occupation within the agency, indicating that there is no single source on which to establish a clear description of the ORA occupation within the agency. This strategic job analysis established a baseline description of the occupation across two major communities of interest (aviation safety and other ORAs). The data might be captured in a standardized database which could be made accessible to local managers via the FAA cloud. At least initially, work statements (activity, duty, task) would have to be selected and exported by a manager and then reformatted into the Job Analysis Template (JAT). Similarly, the manager could select and export competency (KSA) statements for inclusion in the JAT for a given ORA position.

Some guidance around tailoring the work and competency statements would have to be developed. For example, a manager in ATO System Operations would need to tailor a JAT around analyses of air traffic flows while a manager in Aircraft Certification might need to include language about modeling aircraft structures. Longer term issues include monitoring usage of the standardized information and assessment of the quality and utility of the resulting JATs.

Observations on Strategic Job Analysis

This strategic job analysis for the ORA occupation, and more specifically, the Safety ORA community, is one example of how to conduct a strategic job analysis. Our approach used both quantitative and qualitative techniques. Other examples of strategic job analysis within the FAA include an assessment of the impact of the Next Generation Aviation System (NextGen; FAA, 2016) technology and procedures on the work performed by and competencies required of air traffic controllers (Broach, 2013; Hendrickson, Krokos, Baumann, Bhupatkar, Norris, & Alonso, 2011; Krokos, & Norris, 2011; Krokos, Bauman, Bhupatkar, McDonald, Hendrickson, Norris, & Alonso, 2011a; Krokos, Bauman, Bhupatkar, McDonald, Hendrickson, Norris, & Alonso, 2011b; Krokos, Bauman, Bhupatkar, McDonald, Hendrickson, Norris, & Alonso, 2011c). In that series of analyses, the drivers of change in the ATCS job were very specific technology procurements such as En Route Automation Modernization (ERAM) and Standard Terminal Automation Replacement System (STARS) which replaced the controller consoles and displays in air route traffic control centers and terminal radar approach control facilities respectively. The approach taken in the controller strategic job analysis was based primarily on document review and analysis supplemented by structured interviews with technology program managers, engineers, and developers. That analysis did not involve any input from job incumbents, supervisors, or Air Traffic executives.

More recently, the Department of Transportation conducted a competency gap analysis for the Aviation Safety Inspector (GS-1825) occupation (Avant Garde, 2016a, 2016b). Those analyses involved surveys of both job incumbents and supervisors. The ASI competencies assessed in the surveys were derived from government-wide and occupation-specific competency models. No description of either the “as is” or “to be” *work* performed by ASIs was provided. Job incumbents rated the importance of each competency and their current proficiency on each competency. Supervisors rated the importance of each competency as well. Supervisors also rated employees’ current proficiency, employees’ required proficiency, and, importantly from the perspective of strategic job analysis, employees’ expected future proficiency. The difference between an incumbent’s self-rated proficiency and the supervisor’s rating of the employee’s proficiency was defined as the “current competency gap.” The “future competency gap” was defined as the difference between the employee’s current average proficiency on a competency (computed as the average of the employee and supervisor rating of current proficiency) and the employee’s expected future proficiency as rated by the supervisor. Importantly, future competencies were the same as current competencies. No new competencies were introduced in the future-oriented analysis. The criticality of a future competency gap was estimated as the product of current importance and future gap (i.e., the difference between current and future required proficiency). Shifts in the importance of competencies themselves were not captured in the DOT analysis. Analysis of such shifts in importance might help in prioritizing the order in which competency gaps are addressed by the department.

This diversity of approaches to analyzing future job requirements illustrates the need to tailor the strategic job analysis methodology to the needs of organization and intended purpose. The ATCS analysis was designed to identify changed personnel selection and new occupational training requirements. The ORA analysis was designed to support changes in recruitment and selection for the occupation via updating the JATs. The ASI analysis was conducted to identify future training needs to close "critical competency gaps" for a mission-critical occupation. Interestingly, none of these analyses was intended to support job (re)design, business process re-engineering, or organizational design.

Finally, another common element in these three analyses of very different occupations was that the "what" of the job or occupation, in terms of both work and competencies, does not seem to radically change. None of the analyses led to the need for the creation of new jobs or occupations or re-classification. However, the continuity is not unexpected: federal agencies do not radically change their mission, and mission drives the occupational structure for a federal agency. In contrast, private sector entities are free to radically change their mission and business focus. For example, IBM famously shifted from computer hardware manufacturing to software development and consulting services over the 1990s and 2000s, resulting in wholesale changes in the work performed and the skills needed by the corporation (Lohr, 2010). Assemblers and integrated circuit designers were laid off in large numbers even as web interface designers and "data scientists" were recruited. In contrast, the FAA mission of overseeing and operating the safest, most efficient, and largest national aviation system in the world is unlikely to change in the foreseeable future. Therefore, the work performed and competencies required are unlikely to dramatically change in a way similar to the IBM experience. Rather, as the analyses reflect for all three occupations, changes in the work and competencies required in the ORA and other occupations will be more a matter of degree rather than kind over the next five to seven years. Yet those changes should be carefully monitored and evaluated on a periodic basis through iterative strategic analyses to ensure continued evolution of the occupation in parallel with the evolution of the U.S. national aerospace system.

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APPENDIX A: SOURCE ORA JOB ANALYSIS TOOL (JAT) DESCRIPTIONS

Organization	Description
AVP-220	The incumbent conducts and/or directs operations research in coordination with the FAA, industry, and/or other governmental entities in support of AVS safety initiatives. Supports the establishment of operations research and methods and techniques (e.g. probabilistic modeling, optimization techniques, applied statistics and decision analysis and data visualization) in support of the mission of the FAA and other key AVS-supported initiatives. Coordinates the organization and execution of major analysis and program development activities of FAA Joint Planning and Development Organization (JPDO), and Commercial Aviation Safety Team (CAST) working groups that consist of FAA staff members, representatives of domestic and international airlines, manufacturers, employee groups, air traffic organizations, and others in the worldwide aviation community. Serves as the FAA focal point on these activities and assists in developing and administering work plans of the groups. Performs activities in organizing and implementing data sharing efforts between FAA and other government organizations, manufacturers, airlines, and employee groups involved in the JPDO Integrated Product Teams (IPTs), CAST, and Aviation Safety Information Analysis and Sharing (ASIAS) working groups to promote and facilitate voluntary collection and sharing of safety information. Work activities also help eliminate barriers that discourage the collection and sharing of safety information.
ANM-290	Incumbent provides Regional analytical support for certain 14 CFR Part 121 Certificate Management Teams (CMTs). Incumbent serves as a technical specialist responsible for the development of mathematical, statistical models and methodologies for analyzing components of the aviation system and aviation safety data using advanced technologies. Identifies future needs and provides recommendations on advanced, innovative, and new research techniques, methodologies, or process. Independently plans and directs the use of time and resources to accomplish FAA ORA program objectives.
AVP-300	The mission of the Safety Management and Research Planning Division is to implement an integrated Agency-wide Safety Management System (SMS) and to collaborate and coordinate with research organizations, industry, and academia to evaluate advanced concepts and proposed solutions through joint research and development projects supporting NextGen, core research and development programs, and other FAA goals and objectives. If you are the person selected for this position, you will be charged with supporting the implementation of SMS across the agency. As a leader and technical advisor in aviation programs, you will directly support the Division manager with the development and program management of SMS. You will have the lead drafting formal documentation as well as the presentation of plans, results, responses and recommendations to a variety of audiences including senior FAA management, Joint Planning Development Office (JPDO), Department of Transportation (DOT), Government Accountability Office (GAO), Office of Management and Budget (OMB), and Congress. You will also collaborate and coordinate with all organizations (internal and external to FAA) within the SMS community.
AOV-320	Serves as an Operations Research Analyst in the Research and Analysis Branch, Safety Management Oversight Division of the Air Traffic Safety Oversight Service. Conducts trend analysis of the National Airspace System (NAS) safety data. Conduct or participate in the review and evaluation of risk associated with policies, standards, procedures and programs relating to the safety of the NAS. Maintain software and hardware capabilities to enable the conduct of operational research analysis, modeling, mathematical and statistical and analyses to support the evaluation of Air Traffic Control

Organization	Description
	operation. Participates in scheduled and unscheduled audits to ensure the Air Traffic Organization (ATO) is in compliance with the Safety Management System (SMS) and air traffic safety standards. Conducts research and operational analyses of data relating to the provision of Air Traffic Services to ensure compliance with safety standards and the ATO SMS. Plans, leads, conducts or participates in audits to measure and determine compliance with established FAA orders, rules, procedures and policies for the purpose of promoting continued operational safety.
ASW-290	Incumbent serves as a team member of the Safety Analysis and Evaluation Branch, ASW-290. Incumbent will use the AVS Safety Management System (AVSSMS) approach in continuously monitoring available data sources to identify risks, events, trends, or patterns to identify and mitigate potential hazards. Provides detailed tailored analyses and information to guide field offices in conducting oversight using system safety and risk mitigation principles. Supports field offices requests for support in the area of research and analysis as well as providing education and guidance on analytical procedures. Remains current with safety risk management data collection systems to include Air Transportation Oversight (ATOS); Safety Assurance System (SAS); and the National Flight Standards Work Program. Coordinates directly with field offices and regional personnel to develop and implement data analysis methods to ensure system safety objectives are met. Represents the FAA as a single point of contact on all matters relating to regional analyses and national ATOS, SAS, and Flight Standards Work Program analysis goals. Provides analytical recommendations and support for senior Flight Standards Management, headquarters and field organization decision-makers.
AFS-42	As an Operations Research Analyst, the incumbent serves as an integral member of the AFS-40 division. He/she will provide analysis to support decision-making. He/she will be responsible for planning, building, analyzing, organizing and supporting aviation safety related research studies, programs, models, and other automated advanced technology tools to conduct timely and accurate analysis. The incumbent identifies, retrieves and organizes sources of data that would support decision-making at higher levels. He/she will coordinate with other employees to ensure that appropriate data is available to support the safety analysis process. He/she will maintain databases for the QMS and audits, analyze the data, and perform comparative analysis on all available data. The incumbent will retrieve, interpret and summarize information using various statistical and analytical tools. He/she defines or refines major and critical problems for approaching and resolving aviation safety related problems. The nature of assignments and data tend to be multifaceted, extensive, and obscurely related. The incumbent will frequently explore relationships between variables to develop proposals for operating procedures, regulations, and standards. He/she designs and analyzes simulated operations for the purpose of obtaining insight or determining factors affecting actual operations. He/she uses data base management systems and statistical software to analyze aviation safety data and trends. When directed, serves as the team leader for assigned projects. Provide information to guide teams and to continually provide analysis to support decision-making. Identify, retrieve and organize sources of data that would support the safety analysis process.
AFS-650	Responsible for the professional and technical aspects of work and interfacing with other team members for whom analytical support is provided. Assumes technical responsibility for presentation, interpretation and application of findings and analysis. Independently recognizes a need, solicits then coordinates assistance from other team members or other field offices. Responsible for the development and application of mathematical and statistical models and methodologies for analyzing components of the aviation system, and aviation safety data using advanced technology. Provides analytical support for decision making by senior Flight Standards Management, headquarter, and field organizations. Applies experience and comprehensive technical knowledge applicable to analysis of the FAA's operational and service data contained in the NPTRS, NVIS, SDRS, AIDS, and other safety information databases to accomplish assignments, and to

Organization	Description
	develop plans and techniques to improve programs and policies. Defines, organizes, and assigns resources to accomplish work activities in support of organizational objectives. Plays a lead role in drafting, reviewing, and editing reports and other documents for final approval. Draws on experience to solve unusual problems and may create new solutions and policy interpretations, as the situation requires. Work activities support and are vital to the organizational objectives of the Flight Standards Service and the line-of-business. Work is reviewed rarely, typically through status reports and at project completion, to ensure technical compliance and alignment with the requirements of the project or other work activity.
AVP-210	The incumbent will serve in the Safety Analysis Branch of the Office of Accident Investigation and Prevention and conduct and/or direct operations research in coordination with the FAA, industry, and/or other governmental entities in support of AVS safety initiatives. He/She will support the establishment of operations research and methods and techniques (e.g. probabilistic modeling, optimization techniques, applied statistics and decision analysis and data visualization) in support of the mission of the FAA and other key AVS-supported initiatives. Coordinates the organization and execution of major analysis and program development activities of FAA Aviation Safety Information Analysis and Sharing (ASIAS), General Aviation Joint Steering Committee (GAJSC), and Commercial Aviation Safety Team (CAST) working groups that consist of FAA staff members, representatives of domestic and international airlines, manufacturers, employee groups, air traffic organizations, and others in the worldwide aviation community. The incumbent will serve as the FAA focal point on these activities and assist in developing and administering work plans of the groups. He/She will perform activities in organizing and implementing data sharing efforts between FAA and other government organizations, manufacturers, airlines, and employee groups involved in the GAJSC, CAST, and ASIAS working groups to promote and facilitate voluntary collection and sharing of safety information. The incumbent's work activities will also help eliminate barriers that discourage the collection and sharing of safety information.
Airports	This position is located at the Federal Aviation Administration within the Office of the Associate Administrator for Airports, Office of Airport Planning and Programming, Planning and Environmental Division, provides continuity in achieving and maintaining a high level of technical analysis, professional expertise, quality control, and public and Congressional confidence in the FAA's management of airport capacity initiatives and integration of Office of Airport initiatives and investments with National Airspace System (NAS) modernization efforts. The incumbent provides technical advice based on technical expertise, understanding of complex analytical models, and interpretation of other quantitative measures and metrics, to FAA, the Department of Transportation, and aviation industry stakeholders regarding the development of new airport capacity and related NAS modernization initiatives. Incumbent conducts quantitative analyses of airport capacity and delay issues that are national in scope as well as resolution of location specific technical problems related to runway and surface capacity and operations. Collaborates with FAA offices to harmonize and share data (such as demand day schedules, aircraft fleet forecasts, delay, and airport throughput) used in system-wide airport capacity evaluations. Develops methodologies that are repeatable and tailorable to alternative future scenarios. Communicates analytical results to inform FAA decision making.
AJR-G2000	The incumbent acts as a principal technical analyst who analyzes and identifies drivers related to the operational performance of the NAS by designing, developing, and adapting statistical models and other research methods. Conducts rigorous, scientific inquiry and analysis to compute metrics and analyze factors applicable to unique and recurring problems in the aviation and aerospace industries including airline operations and other aviation related fields. Uses sound, scientific and quantitative information to provide overall project results, technical reports, and/or recommendations

Organization	Description
	to management as a basis for making decisions. Conducts complex analyses of factors which affect trends in the NAS to identify failures in current systems and procedures and provide possible alternative solutions and findings. Provides guidance to lower level staff on how to solve difficult technical issues. Applies experience and comprehensive, technical knowledge of analytical and statistical theories, principles, concepts, methods and techniques to accomplish assignments and develop plans to improve operations in the NAS. Develops and integrates solutions to complex problems. Typical assignments include: statistical model design and adaptation, extensive investigation and research analysis activities, compliance and enforcement actions, and direct responsibility for project/program management. Acts as the authoritative source of technical input to research projects and documents. Assignments are performed under minimal direction of a manger. The supervisor provides administrative direction for projects in terms of broadly defined missions. The employee independently plans, designs and carries out the work to be done; defines, organizes, and assigns resources to accomplish organizational objectives; and allocates resources to accomplish large work activities within established schedules. The supervisor reviews the work for potential impact on broad agency policy objectives and program goals. Work is reviewed rarely through status reports and at project completion. Broad policies and objectives provide general guidance for addressing issues, but allow considerable discretion to develop new and innovative approaches. Draws on experience to solve unusual problems and create new solutions and policy interpretations as the situation requires. Provides policy guidance and instruction to others, both internally and externally. Work involves originating new and improved applications and strategies for existing and new concepts and principles related aviation and airline operations. Work activities typically support and are vital to the success of projects or activities of the ATO, Federal Aviation Administration (FAA) and aviation industry when adopting new approaches and technologies. The work affects the safety and security of the flying public. Contacts are internal and external including FAA management, Departmental officials, and individuals within the aviation and aerospace industries. The incumbent often represents FAA as a senior technical point of contact on projects. The purpose of the contacts is to justify, defend, negotiate, or settle matters involving significant or controversial topics. Performs other duties as assigned.
AJR-G2000	The incumbent acts as a principal technical analyst who analyzes and identifies drivers related to the operational performance of the NAS by designing, developing, and adapting statistical models and other research methods. Conducts rigorous, scientific inquiry and analysis to compute metrics and analyze factors applicable to unique and recurring problems in the aviation and aerospace industries including airline operations and other aviation related fields. Uses sound, scientific and quantitative information to provide overall project results, technical reports, and/or recommendations to management as a basis for making decisions. Conducts complex analyses of factors which affect trends in the NAS to identify failures in current systems and procedures and provide possible alternative solutions and findings. Provides guidance to lower level staff on how to solve difficult technical issues. Applies experience and comprehensive, technical knowledge of analytical and statistical theories, principles, concepts, methods and techniques to accomplish assignments and develop plans to improve operations in the NAS. Develops and integrates solutions to complex problems. Typical assignments include: statistical model design and adaptation, extensive investigation and research analysis activities, compliance and enforcement actions, and direct responsibility for project/program management. Acts as the authoritative source of technical input to research projects and documents. Assignments are performed under minimal direction of a manger. The supervisor provides administrative direction for projects in terms of broadly defined missions. The employee independently plans, designs and carries out the work to be done; defines, organizes, and assigns resources to accomplish organizational objectives; and allocates resources to accomplish large work activities within established

Organization	Description
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AFI-200	The incumbent will function as a cost analyst responsible for overall development, evaluation, and quality assurance of independent government cost estimates, in support of investment decisions within the Air Traffic Organization and other FAA lines of business or directorates. The incumbent works as part of a team that conducts analyses that involve technical parameters, acquisition and logistics requirements, schedule constraints, accounting, procurement and business principles, and similar cost-influencing factors. He/she will also provide recommendations to senior cost analysts that guide inter-disciplinary teams in the design, development, and application of cost analysis tools to determine the economic impact of proposed changes. The incumbent will review procurement packages including schedule, performance metrics, and statement of work. For all analyses and reviews, the incumbent prepares formal documentation and presents plans, results, and recommendations to team leads, management and others verbally and in writing. Knowledge in applying the principles and practices of independent government cost estimating and conducting cost analyses of Federal procurements. Ability to present clear and concise information consistent with the targeted audience, including providing input to the development and presentation of high-level decision briefings and issue papers. Ability to work independently, as well as collaboratively with others and/or participating on inter-disciplinary teams. Ability to develop procurement packages including statement of work, performance metrics, and schedules. Experience with researching and analyzing procurement information, data, and/or reports and recommending solutions.
AFI-200	The incumbent will function as a senior cost analyst within the Financial Services, Investment Planning and Analysis Division (IP&A), Lifecycle Cost Estimating Branch; responsible for overall development, evaluation, and quality assurance of cost estimates, including ad-hoc special studies, in support of investment decisions within the Air Traffic Organization and other FAA lines of business or directorates. The cost estimates may encompass program baseline development, budget and life cycle cost estimates, feasibility studies and sensitivity analyses, contract evaluation and contract solicitation support, cost performance monitoring and analysis, and independent cost estimates and analyses. The incumbent conducts analyses that involve complex technical parameters, acquisition and logistics requirements, schedule constraints, accounting, procurement and business principles, and similar cost-influencing factors. The incumbent will also guide inter-disciplinary teams in the design, development, and application of cost analysis tools to determine the economic impact of proposed changes. The incumbent may also participate in database development, cost estimating process improvement and Cost Estimating Standards and Guidance development. For all analyses and reviews, the incumbent prepares formal documentation and presents plans, results, and recommendations to senior management and

Organization	Description
	others verbally and in writing. Skill in applying the principles and practices of cost estimation and conducting cost analyses. Ability to present clear and concise information, including the development and presentation of high-level decision briefings and issue papers and the conduct/facilitation of meetings involving negotiations and contentious issues. Skill in leading and/or participating on inter-disciplinary teams. Experience in developing cost estimates and leading, evaluating or conducting independent cost estimating evaluations and program assessments for complex systems.
AFI-200	The incumbent is responsible for the design and development of models, methods, and computer applications to apply mathematical, statistical, and econometric techniques to analyze proposed changes to the National Airspace System (NAS) changes that might affect system factors such as costs, benefits, efficiency, and service levels. Utilizes algebraic and operations research techniques, and information systems to address issues related to modernization of the NAS. Incumbent will be responsible for evaluation and quality assurance of business cases in support of the Air Traffic Organization (ATO) and FAA lines of business. Gathers, organizes, and analyzes related economic data, prepares graphical presentations, assists in technical writing. Develops documents and enhances analytical methodologies. Participates in complex studies including operational studies, benefit assessment, feasibility studies, and cost/benefit studies in support of investment decisions within the ATO and other FAA lines of business or directorates. The incumbent will play a key role in analyzing and recommending investment opportunities, including the timing and interdependencies within a complex portfolio of systems that support air transportation. Works in inter-disciplinary teams in the design, development, and application of tools to determine the economic impact of proposed changes. Responsible for preparing formal documentation for all analyses and reviews, and to present plans, results, and recommendations to team leads and management. Skill in conducting and evaluating analytical studies and participating on inter disciplinary teams. Ability to utilize common information systems applications, and to develop computer programs to access large complex databases. Ability to present technical information, including the development and presentation of high-level decision briefings and issue papers. Knowledge and experience with Enterprise Architecture concepts, design, and tools. Knowledge of quantitative management techniques. Experience using quantitative techniques, especially multivariate regression analysis, simulation and mathematical optimization to address complex technical issues and/or analysis of benefits
AFI-200	The incumbent will serve as an Operations Research Analyst with the Resource Optimization Division in the Office of Labor Analysis. Incumbent is responsible for participating and possibly leading certain aspects of studies to optimize resource allocation for major components of the agency workforce. Using operations research, statistical, econometric, and/or industrial engineering techniques, design and implement automated computer systems, including relational data base management systems used to optimize agency resources. Uses a variety of standard and advanced qualitative and quantitative analytical techniques and procedures to design, develop, and administer independent/interdependent studies concerned with agency resource requirements for various agency programs. Collects and analyzes data, identifies existing and potential problems or trends, formulates alternatives, and provides recommendations to the supervisor for consideration. Responsible for developing mathematical and/or statistical models to represent current agency processes and procedures in the areas of resource utilization. Evaluates existing models through the use of such quantitative methods as correlation, regression analysis, and workload scheduling. These models will be used to develop and forecast resource requirements, allocate resources to regions and facilities, and sensitivity analyses to answer management's "what if" questions for different courses of action. Develops, monitors, and trains others on best practices related to resource optimization. Identifies and analyzes resource constraints that impact operational efficiency. Prepares

Organization	Description
	documentation, reports, and/or presents briefings in his/her area(s) of expertise. Reports cover all aspects of a problem including problem identification, approach to solution, alternatives, outcome, and recommendations. Incumbent acts as a contributing specialist on large work activities for single or small work activities. Skill applying advanced qualitative and quantitative analytical techniques and procedures. Advanced skill in analysis, synthesis, and correlation of data. Skill in utilizing computer software for operational research and/or industrial engineering applications. Skill in conducting and evaluating analytical studies for complex systems. Advanced skill in communicating and presenting technical and complex information, including the development and presentation of high-level decision briefings to a diverse audience, and in leading and/or participating on interdisciplinary teams.
AFS-900 ADP Workgroup (2005)	Guide and perform research and analyses to evaluate safety, changes and system stability associated with 14 CFR Part 121 certificates. Develop mathematical, statistical models and methodologies for analyzing aviation management and operational systems and aviation safety data using advanced technologies and multiple at variance data sources. Identify future needs. Provide recommendations on advanced, innovative, and new research techniques, methodologies, or processes. Plan and direct use of time and resources to accomplish local, regional, and national FAA analysis program objectives. Coordinates directly with local and regional staff to develop and implement data analysis methods to ensure program objectives are met. Represents FAA as a single point of contact on all matters relating to regional analyses and national program goals. Provides analytical recommendations and support for senior management, Headquarters, and field organization decision-makers.
ANG-C64	As the subject matter expert and the operations research program manager in the Policy and Requirements Branch, ANG-C64, you will manage employees and contract staff in the planning and execution of the Aviation Weather Metrics Program and a wide variety of program support to the Aviation Weather Division. Using your expert knowledge, you will be responsible for planning, technical direction, and timely execution of capabilities to measure the [a] impact of weather on NextGen operations; [b] the qualitative and quantitative gaps in current weather information; and [c] the impact of improved weather information on the operation of the NAS in NextGen. You will also be responsible for the development and execution of systems and procedures for the division to establish and track Destination 2025 and Business Plan targets; analyze, establish, and track financial management; and provide acquisition management. You will support the operations research and benefits analyses needs of the Aviation Weather Division, the NextGen Performance and Outreach Office and ATO elements, including AJR and the new PPO. In so doing, you will be the primary interface and point of contact with government program authorities and presentations on technical and program/project issues for weather metrics, as well as a leader in metrics program/project operations, acquisition management and employment of metrics program/project resources (to include technical and financial reports to demonstrate progress to senior FAA officials.)
ANG-C42	The mission of the Advanced Operational Concepts Division is to design and conduct simulation and analysis activities to support concept development and validation which includes the development of Concept Operations (ConOps) and Concept of Use (ConUse) requirements for future National Airspace Systems (NAS) operations and technologies. If you are selected for this position at the FV-* band, you will be responsible for conducting operations research on various engineering and research projects to support operational concept feasibility assessment, shortfall analysis, and benefits analysis. You will support the planning and management of engineering and research projects including conduct of strategic studies, and development and validation of operational concepts. The areas of concentration will include air traffic control systems, air traffic operations, communications, navigation, and surveillance system integration. You will

Organization	Description
	assess current operational data to identify operational shortfalls. You will perform multiple assignments under the limited direction of a manager or team leader in the preparation of technical documentation for concept development and technical studies, compilation and analysis of operational performance, cost, benefit, and engineering data. If you are selected for this position at the FV-* band, in addition to the above duties, you will: 1) modify and adapt standard behavioral science techniques to the unique aspects of air traffic control systems, plans multi-disciplinary research, and engineering projects; 2) present findings and make recommendations and; 3) work collaboratively with the operational service units to ensure that the research/engineering program is focused on solving the air traffic problems of the future National Airspace System (NAS) and evolving the NAS to the Next Generation Air Transportation System (NextGen). Through your knowledge and working experience in the development of project requirements; you will also select appropriate test, measurement, and analysis procedures.
ANG-C42	If you are the person selected for this position you will be considered an expert technical advisor in aviation programs and in the development of new and innovative analysis concepts in support of the integration of new or emerging technology for modernization of the National Airspace System (NAS). You will be responsible for: (1) developing standards and protocols to continually improve accuracy and consistency of cost estimates; (2) conducting independent reviews of cost estimates prepared by others and making recommendations regarding the estimates' sufficiency and suitability; (3) participating in complex studies including operational studies, benefit assessment, post-implementation analysis and cost/benefits studies supporting improvements to the corporate integration/planning process; (4) integrating budget and technology development planning; (5) linking organizational performance to overall agency strategic goals; (6) preparing formal documentation and presenting plans, results and recommendations to a variety of audiences; (7) leading and managing developmental contractual efforts (i.e., contractual, administrative, deliverables management, program performance metrics and financial management); (8) administering procedures and plan development, and directing execution of the technical, programming, maintenance and administrative efforts, including monitors and progress reporting; (9) interfacing with other government program authorities and representatives on technical and program/project issues and; (10) preparing, monitoring, and tracking formal documentation, plans, results and recommendations to a variety of audiences. In addition, you will provide support and input on other developmental efforts and business management activities with other Division Managers and their project managers. You will work with other government agencies to further the integration of planning and budgeting of NAS activities. Other duties may include: supporting development and coordination of new concepts of operation and/or technologies with research management plans, system design trade studies, system engineering and human factors analyses and; contributing to the development and coordination of prototyping and testing of integrated demonstration and evaluation strategies, as well as participating in the collection and evaluation of investment decision data and the formulation of NAS operational implementation plans for presentation to FAA senior managers. Performance of these duties will require establishing and managing multiple procurement contracts and close collaboration with the contracting community, as well as other aviation community stakeholders across the FAA and private industry.
ANG-51	We are looking for a highly motivated, innovative individual to help the FAA implement its Next Generation Air Transportation System (NextGen). NextGen will transform the U.S. aviation system using 21st Century technologies to meet future demands, improve safety, and protect the environment. The successful candidate will provide support to the NAS Modeling Division, Systems Analysis & Modeling Directorate in the Office of the Assistant Administrator for NextGen. If you are selected for this position at the FV-* level, you will work with staff of the NAS Modeling Division, support

Organization	Description
	contractors, and other stakeholders within and outside the FAA to analyze the performance of NextGen-related technologies and procedures using sophisticated modeling tools. You will be specifying requirements for new model functionality to better represent the existing and evolving NAS and will work with contractors to enhance models to incorporate this new functionality. Other responsibilities include: (1) collecting and analyzing operational data for use as model inputs and to validate model outputs; (2) debugging new software releases; (3) developing related research plans and statements of work for contractors and universities; and (4) developing professional reports and presentations, documenting analytical results, and presenting findings to management. You will also serve as technical lead for external studies, and mentor junior staff. If you are selected for this position at the FV-* level, you will take on more of a leadership role, with additional responsibilities including: (1) raising management or policy issues to the Director for timely resolution by actively monitoring the activities and plans of the Group; and (2) developing an accurate and integrated understanding of significant management concerns and reporting the Group's progress to the Director. You will also work in partnership with other FAA offices and aviation industry organizations, boards, and committees in developing tailored solutions for NextGen activities and outstanding concerns as they relate to the Group.
ANG-51	We are looking for a highly motivated, innovative individual to help the FAA implement its Next Generation Air Transportation System (NextGen). If you are the person selected for this position, you will provide support to the NAS Modeling Branch, located within the Systems Analysis & Modeling Division in the FAA's NextGen Organization. If you are selected for this position at the FV-* level, you will work with the staff of the NAS Modeling Branch, support contractors, and other stakeholders (within and outside the FAA) to analyze the performance of NextGen-related technologies and procedures using sophisticated modeling tools. You will be specifying requirements for new model functionality to better represent the existing and evolving NAS, and work with contractors to enhance models to incorporate this new functionality. You will collect and analyze operational data for use as model inputs, to validate model outputs, and debug new software releases. You will be responsible for developing professional reports and presentations, documenting analytical results, and presenting your findings to management. If you are selected for this position at the FV-* level, in addition to the above responsibilities, you will serve as a technical lead for external studies and be asked to mentor junior staff members. You will also be developing research plans and statements of work for contractors and universities.
ANG-C2	The mission of the Research & Development (R&D) Integration Division is to collaborate and coordinate with research organizations, industry, and academia to evaluate advanced concepts and proposed solutions through joint research and development projects supporting NextGen, NAS Enterprise Architecture, core research and development programs, and other FAA goals and objectives. If you are the person selected for this position, you will be a member of the Unmanned Aircraft Systems (UAS) R&D portfolio team, charged with supporting the Integration of UAS in the NAS. As a leader and technical advisor in aviation programs, you will directly support the Division manager with the development and program management of the FAA's UAS Center of Excellence. You will have a lead role in the oversight, management, and execution of all phases of the UAS Center of Excellence lifecycle: Pre-solicitation, Solicitation, Evaluation, Contract award, Administration and Technical Monitoring. In addition, you will participate in the preparation of formal documentation as well as the presentation of plans, results, responses and recommendations to a variety of audiences including senior FAA management, Joint Planning Development Office (JPDO), Department of Transportation (DOT), Government Accountability Office (GAO), Office of Management and Budget (OMB), and Congress. You will also collaborate and coordinate with all organizations (internal and external to FAA) within the UAS community.

Organization	Description
ANG-C5	The mission of the Advanced Concepts and Technology Development Office is to manage the Research, Engineering & Development (R, E&D) program to assure alignment with the agency's Flight Plan, the NextGen Concept of Operations and agency strategic and business plans. They are responsible for: providing U.S. leadership in the coordination of aviation research with international organizations worldwide; identifying, executing and managing research and development projects related to existing and new technologies and procedures consistent with FAA's mission; managing, directing and coordinating the agency's human factors program, and the aircraft and airport safety programs; managing FAA liaison offices at NASA's Langley and Ames Research Centers and; serving as the agency's R&D spokesperson and maintain liaison with other agencies, industry, and foreign governments. If you are selected for this position, you will be considered an expert technical advisor in aviation programs and in the development of new and innovative analysis concepts in support of the integration of new or emerging technology for modernization of the National Air Space (NAS) system. You will be responsible for: (1) developing standards and protocols to continually improve accuracy and consistency of cost estimates; (2) conducting independent review of cost estimates prepared by others and making recommendations regarding the estimates' sufficiency and suitability; (3) participating in complex studies including operational studies, benefit assessment, post-implementation analysis and cost/benefits studies supporting improvements to the corporate integration/planning process; (4) integrating budget and technology development planning; (5) linking organizational performance to overall agency strategic goals and; (6) preparing formal documentation and presenting plans, results and recommendations to a variety of audiences; (7) leading and managing developmental contractual efforts (i.e., contractual, administrative, deliverables management, program performance metrics and financial management); (8) administering procedures and plan development, and directing execution of the technical, programming, maintenance and administrative efforts, including monitors and progress reporting; (9) interfacing with other government program authorities and representatives on technical and program/project issues and; (10) preparing, monitoring, and tracking formal documentation, plans, results and recommendations to a variety of audiences. In addition, you will provide support and input on other developmental efforts and business management activities with other Division Managers and his/her other project managers. You will work with other government agencies to further the integration of planning and budgeting of NAS activities. Other duties may include: supporting development and coordination of new concepts of operation and/or technologies with research management plans, system design trade studies, system engineering and human factors analyses and; contributing to the development and coordination of prototyping and testing of integrated demonstration and evaluation strategies, as well as participating in the collection and evaluation of investment decision data and the formulation of NAS operational implementation plans for presentation to FAA senior managers. Performance of these duties will require establishing and managing multiple procurement contracts and close collaboration with the contracting community, as well as other aviation community stakeholders across the FAA and private industry. While serving in this capacity, you will be called upon to manage the activities of as many as 30 federal employees and over S100M of developmental activities.
ANG-C53	NextGen is the FAA's program to develop the Next Generation Air Transportation System. The mission of the Business Case Integration Branch of the Systems Analysis and Modeling Staff is to provide a comprehensive picture of the costs, benefits, and risks of NextGen to the FAA and its customers. Our goal is to provide the information necessary for the FAA leadership to make informed choices about various alternatives within NextGen, and to be able to effectively communicate with stakeholders regarding those choices. If you are the successful candidate selected for this position at the FV-I pay band, you will provide support to the Business Case Integration Branch in areas such as: 1. Estimating the

Organization	Description
	benefits of NextGen operational improvements, both actual and planned, using accepted economic analysis techniques. 2. Providing FAA leadership with an integrated view of the costs and benefits of FAA's NextGen programs, with an emphasis on cross-program dependencies and synergies. 3. Supporting the development of portfolio business cases, taking into account the costs, benefits, and risks of multiple programs, or program segments, that depend upon each other in order to achieve their full functionality. 4. Developing models of the avionics equipage decisions facing aircraft owners and operators in order to better understand: (a) the expected total cost of NextGen avionics for the user community, (b) the percentage of users who will likely be equipped at each point in time, and (c) what steps, if any, the agency may need to take in order to ensure that enough users are adequately equipped. 5. Preparing reports and briefings for internal and external audiences, as required. If you are the successful candidate selected for this position at the FV-J pay band, in addition to the above responsibilities, you will take on more of a leadership role and be responsible for coordinating with other offices within the FAA, as well as with outside contractors, to obtain information and support needed for the above tasks.
ANG-C53	As the manager of the EnRoute/Oceanic Prototyping Branch, ANG-C53, you will be an expert technical advisor and subject matter expert in aviation programs and the development and integration of new and innovative analysis concepts in support of new or emerging technology for National Airspace System (NAS) modernization. Responsibilities will include: (1) developing standards and protocols that improve accuracy and consistency of cost estimates; (2) conducting independent reviews of cost estimates and making recommendations regarding their sufficiency and suitability; (3) participating in complex studies that include operational studies, benefit assessments, post-implementation analysis and cost/benefits studies supporting improvements to the corporate integration/planning process; (4) planning and developing budget integration and technology; (5) linking organizational performance to agency strategic goals; and (6) preparing documentation and presenting plans, results and recommendations. You will be the lead, manager, and administrator for developmental integration and all contractual efforts. You will establish and manage multiple procurement contracts, while collaborating with the contracting community, aviation stakeholders, and private industry. You will develop and monitor procedures, plans and execution of technical, programming, maintenance and administrative support efforts and serve as the primary interface and point of contact with other government officials and representatives on technical and program/project issues. You will also be responsible for preparing and monitoring documentation of plans, results, and recommendations. You will support/share the integration of other developmental efforts and business management activities with the Division Manager and other project managers, working to further the integration of planning and budgeting of NAS activities with other government agencies. You will initiate, lead and support project planning and execution activities that lead toward the formulation, engineering, development, demonstration, text and business case analyses of NAS modernization and technology applications. You will also support (1) development and coordination of new concepts of operation, research, management plans, system design, trade studies, system engineering and human factors analyses; and (2) development and coordination of prototyping, test, demonstration and evaluation strategies. You will be participating in the formulation of NAS operational implementation plans and investment decision data for presentation to FAA senior managers.
ANG-C64	As the subject matter expert and the operations research program manager in the Policy and Requirements Branch, ANG-C64, you will manage employees and contract staff in the planning and execution of the Aviation Weather Metrics Program and a wide variety of program support to the Aviation Weather Division. Using your expert knowledge, you will be responsible for planning, technical direction, and timely execution of capabilities to measure the [a] impact of weather

Organization	Description
	on NextGen operations; [b] the qualitative and quantitative gaps in current weather information; and [c] the impact of improved weather information on the operation of the NAS in NextGen. You will also be responsible for the development and execution of systems and procedures for the division to establish and track Destination 2025 and Business Plan targets; analyze, establish, and track financial management; and provide acquisition management. You will support the operations research and benefits analyses needs of the Aviation Weather Division, the NextGen Performance and Outreach Office and ATO elements, including AJR and the new PPO. In so doing, you will be the primary interface and point of contact with government program authorities and presentations on technical and program/project issues for weather metrics, as well as a leader in metrics program/project operations, acquisition management and employment of metrics program/project resources (to include technical and financial reports to demonstrate progress to senior FAA officials.)
ANG-D2	The FAA will implement operational changes to improve the performance of the National Airspace System in the short term while building the foundation for NextGen capabilities to come. The agency has created a portfolio framework to manage the implementation of both immediate improvements and the large-scale integration of NextGen capabilities, including airfield improvements; advances in surveillance, navigation, communication and traffic flow management; and new automation and information exchange technology. NextGen solution sets contain interdependent projects that work together to provide capabilities to targeted user groups and areas. The solution sets constitute the primary construct for NextGen pre-implementation budget development. The Flexible Terminals and Airports (FLEX) Solution Set provides capabilities necessary to increase access to and manage the separation of aircraft in the terminal environment at and around all airports; large and small. FLEX addresses initial surface management capabilities, procedures that improve access to runways in low visibility, and new automation that will support and maximize the use of available data to enable surface trajectory-based operations. These capabilities will improve safety, efficiency and overall capacity in reduced visibility. The Collaborative Air Traffic Management (CATM) Solution Set provides capabilities to improve traffic flow management system-wide as well as at the tactical, or location-based, level. This solution set focuses on delivering services to accommodate flight operator preferences to the maximum extent possible. CATM supports a more flexible air traffic system capable of in-flight adjustment to alternate, more favorable routings and altitudes as well as the ability to shift traffic operations to match airspace and airport capacity. The elements of the NAS Lifecycle Integration portfolio represent the full range of activities required to realize the maturity of NextGen concepts, including research, engineering studies, demonstrations, and business case analysis and concept validations. If you are selected for one of these positions, you will be responsible for the development and management of the integrated Solution Set portfolio leads. As a Solution Set Coordinator (SSC), you will coordinate acquisition program activities and other supporting activities to ensure systems implementation. You will be responsible for: 1) proactively identifying portfolio gaps and facilitating timely resolution of issues; 2) preparing written reports and briefings on business processes, portfolio management, and/or portfolio content; 3) providing the necessary portfolio plans and performance reports to communicate resource allocations and support agency NextGen decision-making; 4) communicating the official agency message on many NextGen topics and; 5) representing the Agency on various working groups and committees. In addition, you will use your expert knowledge of aviation concepts, products and/or procedures; technology development and/or transfer practices; acquisition processes and; project management to work with various FAA organizations to ensure the system of systems integration required to successfully implement the operational improvements in the CATM and FLEX Solution Sets.

APPENDIX B: ADDITIONAL JOB DUTY OR KSA STATEMENTS FROM SURVEY

Open-Ended Response	Mapped To	New Topic
Lean Six Sigma, which teaches approximately 90% of what's needed to be a successful ORA. It may be best to recruit ASE's and ASI's, train them in Lean Six Sigma and have them do a 2-4 year tour in this position.		Knowledge of (statistical) quality control procedures
Decision analysis, fault tree analysis and monte carlo simulation	Theories, principles, methods, techniques, and tools for modeling and simulation	
Geographic Information Systems (GIS)	Data visualization methods, technologies, and techniques	
AFS ORAs all need to learn SQL to extract data from the FAA data sources. Using MS Access is too limiting.	Database structure, procedures, maintenance, management, and administration	
inferring/discovering needs of management based on requests.	FAA leadership agenda	
job task - join relational databases in order to pull a comprehensive data set	Database structure, procedures, maintenance, management, and administration	
Knowledge of software tools; i.e. Crystal Reports, WinSQL	Database structure, procedures, maintenance, management, and administration	
Use of query languages and tools to extract data.	Database structure, procedures, maintenance, management, and administration	
Knowledge of Microsoft Sharepoint. Basic skills in Microsoft Sharepoint.	Using general office automation applications (Word, Excel, etc.)	
Basic understanding of database query language such as SQL.	Database structure, procedures, maintenance, management, and administration	
Future FAA ORAs need to be well versed on databases, and must have the ability to extract data thru report writing. Also, publishing of reports on-line. I would suggest a Computer Science Degree or Analyst with Report writing and publishing skills: Plus Mechanical Knowledge of Aircraft and their Systems.	Database structure, procedures, maintenance, management, and administration; Communicating complex, technical, analytic results through a variety of media	Aircraft systems knowledge
Knowledge of database's, SQL	Database structure, procedures, maintenance, management, and administration	
Ability to collaborate and communicate across various job functions and levels of an organization.	Organize and direct a group in pursuit of a mutual goal	
Ability to think outside the box. The ORA is a minority in the FAA workforce. A lot of time it is left to us to relate to the job tasks of the majority; to do this we need to be able to think outside the box to ask questions and gain	Apply ideas, concepts, and practices from multiple disciplines and/or perspectives to create solutions to problems	

Open-Ended Response	Mapped To	New Topic
understanding rather than expecting the majority work force to think like an analyst and provide us with text book data for modeling.		
Collaboration amongst other ORAs.	Organize and direct a group in pursuit of a mutual goal	
People Skills	Organize and direct a group in pursuit of a mutual goal	
Being able to 'tell a story' using data/information, and not just present data. Turn technical information into plain language for the business.	Present information in order to influence the opinions or actions of others; Communicating complex, technical, analytic results through a variety of media	
Education in aviation safety and history. Familiarization with aviation industry, i.e., manufacture of aircraft, accident/incident studies, history of the FAA, and the relationship to domestic and foreign commerce.	Structure and operations of certified air carriers, supplemental, cargo, and air taxi organizations; FAA organization, mission, functions, and operations	
Knowledge of Analytical Methodologies, skills in root cause analysis, knowledge of techniques used to quantify risk, analytical tools (ability to write SQL - query rational databases)	Statistical analysis methods and techniques; Methods for quantifying scope, scale, frequency, prevalence, and incidence of hazard	
Communication in workgroup / panel environments.	Present information in order to influence the opinions or actions of others; Facilitation techniques for group discussions; Identify differences or conflicts among individuals	
Depth of domain knowledge of Air Traffic Operations, Flight Standards duties and Airport Operations are extremely important to develop solutions applicable for the entire FAA. Specific knowledge for items such as Order 7110.65, TERPS (Flight Standards), SMS manual etc. are of paramount importance to provide feasible solutions for Safety and Efficiency challenges.	FAA organization, mission, functions, and operations; SMS principles, policies, processes, and tools as applied to aviation	
Theory, design and practice of organizational structure, development of strategic vision, leadership, development of institutional ethics and norms, institutional development and change management. Theory, design and practice of research methods especially of volatile, controversial, highly sensitive or high consequence issues. Theory, design and practice of inter-organizational collaboration to facilitate achievement of symbiotic and mutual goals. Inter-group conflict and resolution theory, design and practice.	Methods for quantifying scope, scale, frequency, prevalence, and incidence of hazard; Facilitation techniques for group discussions; Conflict resolution	

APPENDIX C: ADDITIONAL COMMENTS FROM SURVEY

Gaining the knowledge that Flight Standards does not value the skill set of the ORA and through the promotion process ensures a very limited career path.

The survey discusses tools, yet tools that are designed to model are not used by the FAA. Therefore, I use personal assets to conduct the more in-depth analysis. I am fluent with SPSS using the software in publishing several juornal articles and a dissertation, yet the organization does not feel the cost is prudent, predominantly due to a lack of understanding of the capabilities associated with the software.

Don't believe management understands what an ORA is or how to use them

APPENDIX D: VISIONARY ORA STRUCTURED INTERVIEW PROTOCOL

ORA "Visionary" Interview Synopsis

The purpose of this interview is to develop a future competency model for the Operations Research Analyst (FV-1515; ORA) occupation involved in data, risk, and safety analytics and programs. The interview is part of a Strategic Competency Analysis (also called Strategic Job Analysis) under the Administrator's Risk-Based Decision Making (RBDM) initiative.

- The first step in the Strategic Competency Analysis was to develop a model of ORA job activities, duties, and tasks and current competency requirements.
- The next step—this interview—focuses on what ORAs might be called upon to do in terms of data, risk, and safety analytic activities, and the competencies that might be required, over the next 5-7 years.
- The third and final step in the Strategic Competency Analysis is to compare the "as is" (from the first step) to the "to be" (the second step, which is the results of these interviews) in a "gap analysis" to identify likely changes in work done by ORAs and the competencies required to do that work.

That gap analysis will be the basis for recommendations in areas such as job descriptions, recruitment criteria, internal and external training requirements, and alignment of ORA resources with emerging work.

The interview is organized into five major parts:

1. Introduction, background, and confidentiality
2. Impact of industry, government, and technical trends on the job of ORAs
3. Changes in the work of ORAs in view of those trends
4. Changes in competencies (KSAs) required of ORAs resulting from changes in the work
5. The biggest challenge for ORAs and closing thoughts

Overall, the interview should take about 60 to 90 minutes.

Introductions

Project background (RBDM strategic initiative)

Risk-based Decision Making (RBDM) is one of the FAA Administrator's four strategic initiatives. The goal of the RBDM initiative is to make aviation safer and smarter. To achieve that goal, the agency will build on safety management system principles to proactively address emergining safety risks. To effectively address those emergent safety risks, the FAA will use consistent, data-informed approaches to making smarter, system-level, risk-based decisions. The foundations for data-based approaches to decision making are (1) the increased availability of safety data from multiple sources, and (2) powerful tools, technologies, and capabilities to analyze safety data.

Identification, collection, management, and analysis of safety data are responsibilities often given to the FAA's operations research analyst (ORA; FV-1515) occupation across multiple lines-of-business. ORAs play a critical role in safety data collection and analysis, and importantly, communicating the results of their analyses to agency decision-makers.

Purpose of interview

The purpose of this interview is to determine the impact of industry, agency, and technical trends on the competencies that will be required of Operations Research Analysts (ORAs; FV-1515) over the next 5-7 years (in the “mid-term”). The interview is part of a Strategic Competency Analysis (also called Strategic Job Analysis) under the Administrator’s Risk-Based Decision Making (RBDM) initiative.

Assurance of confidentiality

All information you provide in this interview is confidential and anonymous. Our report will be based on a composite of interview results, and nothing will be attributed to any specific participant.

Informed consent paperwork

We are required by federal regulations for the protection of human subjects in research (Title 45 of the Code of Federal Regulations, section 46.117 (45 C.F.R. § 46.117, to be specific) to document that you gave informed consent to participate in this interview. To document that you consented, please read and then sign the Interview Informed Consent Form.

Background questions

We’d like to get some general background about you. The background information will be used to summarize the overall background of participants.

Briefly, what is the overall mission or work focus for your current organization?

What is your position and what are your general responsibilities?

About how long have been in your current occupation?

About how long have you worked for the FAA?

About how long have you held this (your current) position?

Impact of industry, government, and technical trends on ORAs

In the course of the RBDM Strategic Competency Analysis, we’ve identified eight (8) major industry, agency, and technical trends that are likely to impact the ORA occupation. I’m going to mention a trend, ask you how much impact that trend might have on the ORA occupation, and then why you think it might (or might not) impact the occupation. There might be other trends that you think are important, and you’ll get the opportunity to talk about those as well after we go through the initial list.

So, for each trend, I’d like you to estimate how much impact it will likely have on the work that will be done by ORAs 5-7 years from now, using the following scale, where

1 = no impact at all on ORA work
2 = very little or minor impact
3 = moderate impact
4 = substantial impact
5 = very great or extensive impact on ORA work.

Similarly, for each trend, I'd like you to estimate to how much impact in 5-7 years that trend will have on the competencies required of ORAs, using the following scale, where

1 = no impact at all on ORA competencies
2 = very little or minor impact
3 = moderate impact
4 = substantial impact
5 = very great or extensive impact on ORA competencies.

Trend #1: Integration of Unmanned Aerial Systems (UAS) into the National Airspace System.

The first trend is the integration of *Unmanned Aerial Systems (UAS) into the National Airspace System*. On a scale of 1 for no impact to 5 for extensive impact, how much impact will *Unmanned Aerial Systems (UAS) into the National Airspace System* have on the work of ORAs about 5-7 years from now? Similarly, how much impact will *Unmanned Aerial Systems (UAS) into the National Airspace System* have on the competencies required of ORAs 5-7 years from now?

Why do you think the *integration of UAS* into the NAS will have (none, minor, moderate, substantial, extensive) impact on ORA work? On the competencies required of ORAs?

Trend #2: Integration of commercial space operations into the National Airspace System.

The second trend is the *integration of commercial space operations into the National Airspace System*. On a scale of 1 for no impact to 5 for extensive impact, how much impact will *integration of commercial space operations into the National Airspace System* have on the work of ORAs 5-7 years from now? Similarly, how much impact will *integration of commercial space operations into the National Airspace System* have on the competencies required of ORAs 5-7 years from now?

Why do you think the *integration of commercial space operations into the National Airspace System* will have (none, minor, moderate, substantial, extensive) impact on ORA work? On the competencies required of ORAs?

Trend #3: Changes in FAA regulatory oversight roles.

The third trend is *changes in FAA regulatory oversight roles*. On a scale of 1 for no impact to 5 for extensive impact, how much impact will *changes in FAA regulatory oversight roles* have on the work of ORAs 5-7 years from now? Similarly, how much impact will *changes in FAA regulatory oversight roles* have on the competencies required of ORAs 5-7 years from now?

Why do you think the *changes in FAA regulatory oversight roles* will have (none, minor, moderate, substantial, extensive) impact on ORA work? On the competencies required of ORAs?

Trend #4: Shift from reactive to proactive oversight of industry and the NAS.

The fourth trend is a s*hift from reactive to proactive oversight of industry and the NAS*. On a scale of 1 for no impact to 5 for extensive impact, how much impact will a s*hift from reactive to proactive oversight of industry and the NAS roles* have on the work of ORAs 5-7 years from now? Similarly, how much impact will a s*hift from reactive to proactive oversight of industry and the NAS* have on the competencies required of ORAs 5-7 years from now?

Why do you think the s*hift from reactive to proactive oversight of industry and the NAS* will have (none, minor, moderate, substantial, extensive) impact on ORA work? On the competencies required of ORAs?

Trend #5: Advances in mathematical modeling of structures, systems, and operations.

The fifth trend is *advances in mathematical modeling of structures, systems, and operations*. On a scale of 1 for no impact to 5 for extensive impact, how much impact will a*dvances in mathematical modeling of structures, systems, and operations* have on the work of ORAs 5-7 years from now? Similarly, how much impact will a*dvances in mathematical modeling of structures, systems, and operations* have on the competencies required of ORAs 5-7 years from now?

Why do you think the *advances in mathematical modeling of structures, systems, and operations* will have (none, minor, moderate, substantial, extensive) impact on ORA work? On the competencies required of ORAs?

Trend #6: "Big Data" and analysis tools

The sixth trend is "*Big Data" and analysis tools*. On a scale of 1 for no impact to 5 for extensive impact, how much impact will "*Big Data" and analysis tools* have on the work of ORAs 5-7 years from now? Similarly, how much impact will "*Big Data" and analysis tools* have on the competencies required of ORAs 5-7 years from now?

Why do you think the "*Big Data" and analysis tools* will have (none, minor, moderate, substantial, extensive) impact on ORA work? On the competencies required of ORAs?

Trend #7: Implementation of NextGen.

The seventh trend is the implementation or transition to the Next Generation Aviation Transportation System (NextGen) with GPS-based position, navigation, and timing services, time-based and trajectory-based operations, and shared separation responsibilities between the flight deck and air traffic control, coupled with increasing automation on both sides. On a scale of 1 for no impact to 5 for extensive impact, how much impact will *implementation of NextGen* have on the work of ORAs 5-7 years from now? Similarly, how much impact will *implementation of NextGen* have on the competencies required of ORAs 5-7 years from now?

Why do you think the *implementation of NextGen* will have (none, minor, moderate, substantial, extensive) impact on ORA work? On the competencies required of ORAs?

Trend #8: Cockpit automation.

The eighth trend is the *increasing automation in the cockpit*, migration of automation tools from large aircraft to high-end business aircraft, as well as on to new general aviation aircraft. On a scale of 1 for no impact to 5 for extensive impact, how much impact will *increasing automation in the cockpit* have on the work of ORAs 5-7 years from now? Similarly, how much impact will *increasing automation in the cockpit* have on the competencies required of ORAs 5-7 years from now?

Why do you think *increasing automation in the cockpit* will have (none, minor, moderate, substantial, extensive) impact on ORA work? On the competencies required of ORAs?

Other trends

What other major industry, agency, and technical trends do you think will have an impact on ORA work and competencies 5-7 years from now?

List any trends mentioned and clarify—is the trend from industry, government, or technical?

For each trend identified by the participant, how much impact will that trend have on ORA work and competencies? Why?

Overall, for all the trends we've discussed, which trend do you think will have the greatest impact on ORA work and competencies?

Impact on major activities of ORAs in data, safety, and risk analytics

So far, we've discussed your overall assessment of the impact of major industry, government, and technical trends on ORA work and competencies. Now we'd like to focus a bit more specifically on how these trends will impact the specific activities of ORAs involved in data, safety, and risk analytics, to dig a bit deeper into the question of how ORA work is likely to change 5-7 years from now.

In the first phase of this project, we identified eleven (11) major job activities performed by ORAs across the agency. I'm going to describe a major duty, and then ask you, in view of the trends we just talked about, to estimate whether that duty will become more or less important 5-7 years from now, where

1 = Much less important (in the future)
2 = Less important
3 = About the same importance (no change)
4 = More important
5 = Much more important (in the future).

Similarly, I will also ask you to estimate whether that duty will be performed more or less frequently in the future, 5-7 years from now, where

1 = Much less frequently (in the future)
2 = Less frequently
3 = About the same frequency (no change)
4 = More frequently
5 = Much more frequently (in the future).

After we go through the list of major activities, then I'll ask about any new or additional activities that ORAs will perform in the future, 5-7 years from now.

Job Duty #1: Research planning.

Research planning refers to the tasks of identifying requirements, planning research projects, identifying (and obtaining) resources required for an analysis project, and related tasks.
Given the industry, government, and technical trends we've been discussing, will *research planning* be less, more, or about the same importance 5-7 years from now?
Will *research planning* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *research planning* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #2: Data management.
Data management refers to the tasks of managing data and data sources, cleaning data, setting data up for analyses, and similar tasks.
Given the industry, government, and technical trends we've been discussing, will *data management* be less, more, or about the same importance 5-7 years from now?
Will *data management* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *data management* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #3: Risk analysis.
Risk analysis refers to the tasks of analyzing failures, hazards, and risks, and related tasks.
Given the industry, government, and technical trends we've been discussing, will *risk analysis* be less, more, or about the same importance 5-7 years from now?
Will *risk analysis* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *risk analysis* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #4: Methods & models development.
Methods and models development refers to tasks such as the development of methods for analysis and modeling, including software and statistical/mathematical tools.
Given the industry, government, and technical trends we've been discussing, will methods and models development be less, more, or about the same importance 5-7 years from now?
Will *methods and models development* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *methods and models development* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #5: Solution development.
Solution development refers to tasks such as development of new solutions or concepts of operation and use or ways of applying or using existing solutions and concepts.
Given the industry, government, and technical trends we've been discussing, will *solution development* be less, more, or about the same importance 5-7 years from now?
Will *solution development* be performed more or less frequently or about the same as it is now?

Briefly, why do you think *solution development* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #6: Communications.
Communications refers to tasks such as presenting research, results, and recommendations in briefings and reports and the production of technical documents.
Given the industry, government, and technical trends we've been discussing, will *communications* be less, more, or about the same importance 5-7 years from now? Will *communications* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *communications* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #7: Program management.
Program management refers to tasks such as assisting in program enforcement and evaluation, supporting program development, and program implementation activities.
Given the industry, government, and technical trends we've been discussing, will *program management* be less, more, or about the same importance 5-7 years from now?
Will *program management* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *program management* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #8: Collaboration.
Collaboration refers to tasks such as participating in FAA teams and workgroups, providing technical guidance, instruction, and analytical support to FAA and other (external) organizations, and representing FAA in external workgroups.
Given the industry, government, and technical trends we've been discussing, will *collaboration* be less, more, or about the same importance 5-7 years from now?
Will *collaboration* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *collaboration* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #9: Cost/benefit analysis.
Cost/benefit analysis refers to tasks such as identifying costs and benefits, conducting the actual cost/benefit analysis, and evaluating cost/benefit analyses developed by other organization(s).
Given the industry, government, and technical trends we've been discussing, will *cost/benefit analysis* be less, more, or about the same importance 5-7 years from now?
Will *cost/benefit analysis* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *cost/benefit analysis* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #10: Budgeting.
Budgeting refers to tasks such as developing an organizational budget and supporting documents.
Given the industry, government, and technical trends we've been discussing, will *budgeting* be less, more, or about the same importance 5-7 years from now?

Will *budgeting* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *budgeting* will be (less, same, more) important and (less, same, more) frequent in the future?

Job Duty #11: Contract management.
Contract management refers to tasks such as developing statement(s) of work and supporting documents and administering contracts.
Given the industry, government, and technical trends we've been discussing, will *contract management* be less, more, or about the same importance 5-7 years from now?
Will *contract management* be performed more or less frequently or about the same as it is now?
Briefly, why do you think *contract management* will be (less, same, more) important and (less, same, more) frequent in the future?

New or additional job activities
Given the trends and activities we've discussed, what new or additional major activities do you anticipate ORAs will perform 5-7 years from now?

For each of those new or additional activities, I'll ask you to estimate how important, overall, each duty is on a scale where
1 = Not at all important
2 = Somewhat important
3 = Important
4 = Very important
5 = Extremely important

How frequently the new or additional activities will be performed in the future, 5-7 years from now, on a scale where
1 = Never
2 = Sometimes
3 = Frequently
4 = Often
5 = Always.

Activities that will no longer be performed
Given the trends we've discussed, what activities, if any, will no longer be performed by ORAs 5-7 years from now?

Competencies required of ORAs

So far, we've discussed the major industry, government, and technical trends that are likely to impact ORA work generally. We've also discussed their work and how it might change more specifically 5-7 years from now in view of those trends.

Now let's turn our attention to the competencies required to perform ORA work. In the first phase of the project, we identified a catalog of the specific knowledge, skills, and abilities ORAs believe are needed in their work. From their responses, we identified 16 competencies. I'm going to review each competency in turn, and ask you to assess whether that competency will become more or less important to the ORA position in light of the emerging trends we discussed. We will use the scale of …

1 = Much less important (than now to ORA work)
2 = Less important
3 = About the same importance (no change)
4 = More important
5 = Much more important (than now to ORA work).

Competency #1: Operations Research Core Technical Knowledge.
Operations research core technical knowledge refers to knowledge of the scientific method, statistical analysis, probability theory, modeling and simulation, and other core knowledge elements of operations research as a discipline.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *operations research core technical knowledge* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think core operations research technical knowledge will be (less, more, same) important in the future?

Competency #2: Mathematical Knowledge.
Mathematical knowledge refers to advanced mathematics through calculus, mathematical logic, methods for representing system behavior over time, data visualization, methods for quantifying attributes such as scope, scale, frequency, prevalence, and incidence, and related knowledge.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *mathematical knowledge* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?

Briefly, why do you think *mathematical knowledge* will be (less, more, same) important in the future?

Competency #3: Procurement Knowledge.
Procurement knowledge refers to topics such as cost estimating procedures, cost/benefit analyses, federal and FAA procurement processes, documentation and related knowledge.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *procurement knowledge* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *procurement knowledge* will be (less, more, same) important in the future?

Competency #4: Aviation Industry Knowledge.
Aviation industry knowledge refers to knowledge of the structure and operations of air carriers and other operators, maintenance and repair organizations, overhaul facilities and similar organizations, and flight training, fixed-base, airport and similar operators.

Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *aviation industry knowledge* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *aviation industry knowledge* will be (less, more, same) important in the future?

Competency #5: Decision Support Systems Knowledge.
Decision support systems knowledge refers to decision support system design, development and validation, software development and testing, integration with an enterprise architecture, and related topics.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *decision support systems knowledge* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *decision support systems knowledge* will be (less, more, same) important in the future?

Competency #6: Systems Analysis Knowledge.
Systems analysis knowledge refers to systems analysis methods and techniques, systems design principles and practices, and related topics.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *systems analysis knowledge* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *systems analysis knowledge* will be (less, more, same) important in the future?

Competency #7: FAA Knowledge.
FAA knowledge refers to knowledge of FAA organization, mission, functions, operations and the agency leadership's agenda.
In terms of skills, the first phase of the project identified five clusters of skills that were important to the ORA job overall.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *FAA knowledge* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *FAA knowledge* will be (less, more, same) important in the future?

Competency #8: Aviation System Safety Knowledge.
Aviation system safety knowledge refers to knowledge about aviation safety data resources, safety standards, and aviation regulations.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *aviation system safety knowledge* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?

Briefly, why do you think *aviation system safety knowledge* will be (less, more, same) important in the future?

Competency #9: Data Analysis.
Data analysis refers to skills in data selection and extraction, screening, and transformation, statistical and trend analysis, and related skills.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *data analysis* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *data analysis* will be (less, more, same) important in the future?

Competency #10: Program/Project Management.
Program/project management refers to skills in project planning, execution of studies, cost/benefit analyses, providing technical guidance, development of acquisition and related documents for a program/project, and related competencies.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *program/project management skills* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *program/project management skills* will be (less, more, same) important in the future?

Competency #11: Risk & Hazard Analysis.
Risk and hazard analysis refers to skills in identifying, describing, and evaluating hazards and risks.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *risk and hazard analysis skills* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *risk and hazard analysis skills* will be (less, more, same) important in the future?

Competency #12: Office Automation.
Office automation refers to skills in using general office automation applications (Word, Excel, etc), a personal computer, keyboard, and mouse, and other common office peripherals.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *office automation skills* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *office automation skills* will be (less, more, same) important in the future?

Competency #13: Deductive Reasoning.
Deductive reasoning refers to skills, under changing conditions, in applying ideas, concepts, and practices from multiple disciplines to create solutions to problems,

application of general rules to a specific problem or situation, and logically combining or grouping objects, data, or ideas.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *deductive reasoning skills* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *deductive reasoning skills* will be (less, more, same) important in the future?

Competency #14: Interpersonal Relations.
Interpersonal relations refers to skills related to identifying differences or conflicts among individuals, organizing and directing a group in support of a mutual goal, persuading others, and establishing rapport and trust with others.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *interpersonal relations skills* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *interpersonal relations skills* will be (less, more, same) important in the future?

Competency #15: Inductive Reasoning.
Inductive reasoning refers to skills in the perception of patterns in data, organizing information into an integrated framework, and reasoning from observed data to general rules.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *inductive reasoning skills* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *inductive reasoning skills* will be (less, more, same) important in the future?

Competency #16: Persistence.
Persistence refers to the ability to sustain effort over long periods of time to achieve a goal.
Given the industry, government, and technical trends we've discussed, combined with the changes in ORA work we expect, using a 1 to 5 scale where 1 is much less important and 5 is much more important, will *persistence* be of more, less, or about the same importance to ORA work in the FAA in 5-7 years?
Briefly, why do you think *persistence* will be (less, more, same) important in the future?

New or additional competencies
Given the trends, activities, and knowledge we've discussed, what additional or new competencies do you think ORAs will need 5-7 years from now?

For each of those new or additional competencies, I'll ask you to estimate how important it will be on a scale where

1 = Not at all important
2 = Somewhat important

3 = Important
4 = Very important
5 = Extremely important.

Then, for each new competency, briefly, why do think each new or additional competency will be (less, more, same) important in the future?

Competencies that will no longer be needed
Given the trends and activities we've discussed, what competencies, if any, will no longer be important to ORAs 5-7 years from now?

Closing

We've talked about the impact of industry, government, and technical trends on the work ORAs might be doing in 5-7 years. We've discussed how those trends might impact specific activities, including new activities, which will be performed by ORAs in the future. We've also talked about the competencies (KSAs) required to perform those activities and how they might change over the next 5-7 years.

Overall, what do you think will be the single largest challenge for the ORA occupation in your organization over the next 5-7 years?

Finally, thinking back over our interview, is there anything else about the ORA job—the work or the competencies required—that you want to add?