Taking Inventory of ACRP Research and the Next Challenges Facing the Airport Industry

DETAILS

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TAKING INVENTORY OF ACRP RESEARCH AND THE NEXT CHALLENGES FACING THE AIRPORT INDUSTRY

This digest reports the results of ACRP Project 11-07, "Developing Problem Statements," a special project undertaken for the ACRP Oversight Committee (AOC) to refine processes, improve guidance, examine ACRP research results, and expand industry outreach to improve upon the quality and quantity of problem statements submitted to the ACRP. The digest updates *ACRP RRD 5: Current and Emerging Issues Facing the Airport Industry* (January 2009) and represents the program's strategy of matching research initiatives to current and emerging challenges in a way that best serves the industry, future members of the AOC, and the ACRP as the program matures. The research was conducted by ACRP staff, assisted by the following contractors: Mead & Hunt, LeighFisher, and the Institute for Transportation Research and Education (ITRE).

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INTRODUCTION

In July 2012, following its annual project selection meeting, the ACRP Oversight Committee (AOC) directed staff to assist in two initiatives: (1) designing and refining methods by which grassroots practitioners (external to the AOC) could author problem statements of high quality and relevance to the ACRP, and (2) designing a collaborative process by which the AOC itself could identify one or more current or emerging issues or themes of strategic importance regarding which ACRP could make meaningful contributions to the airport industry. The AOC intended that these two initiatives support and extend the ACRP's value to the industry as the program matures into an increasingly effective research program.

The two initiatives involved significant input from both a broad group of practitioners and a cadre of professionals with industry policy and programming expertise. The first (external) initiative engaged a much larger, grassroots group of industry practitioners in stimulating discussions about research needs and how best to educate practitioners as to the key elements that make a compelling ACRP problem statement. The second (internal) initiative engaged the AOC and a select group of industry executives to define one or more emerging megatrends (critical issues) expected to have a significant impact on airports and the aviation industry in order to ensure that, of the many research ideas submitted to the ACRP, those selected to develop proposals (and, ultimately, to receive sponsored research funding) would capture the issues most important to the airport industry.

BACKGROUND

The ACRP research process begins with a widely broadcast call for research ideas (called *problem statements*) from the industry. In response to this grassroots

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Table 1 Sources of ACRP problem statements, FY2005–FY2014.

	2005–2009	2010	2011	2012	2013	2014
Organization	#	#	#	#	#	#
Airport Operator	65	27	12	35	16	24
State DOT	28	4	0	3	7	7
FAA	18	23	5	5	2	6
Airport Industry Association	38	18	7	3	0	0
Airlines/Airline Associations	0	0	5	1	0	0
TRB	16	9	5	4	1	6
Other Airport Industry	48	9	7	10	0	0
University	90	47	12	9	9	9
Consultant	142	80	50	53	48	53
Other	27	2	1	3	6	3
Total	**472**	**219**	**104**	**126**	**89**	**108**

solicitation, anyone can submit a brief description of a common problem or current challenge facing airports or aviation industry organizations. Since its inception in 2005, the ACRP has received more than 1,110 problem statements from various industry stakeholder groups (see Table 1).

Once received, problem statements are categorized within an established system of 11 *research fields:* Administration, Environment, Policy and Planning, Safety, Security, Human Resources, Design, Construction, Maintenance, Operations, and Special Projects (Table 2).

Table 2 ACRP research fields.

Number	Subject
01	Administration
02	Environment
03	Policy and Planning
04	Safety
05	Security
06	Human Resources
07	Design
08	Construction
09	Maintenance
10	Operations
11	Special Projects (uncategorized)

Considering the research needs of the airport industry, the AOC identifies the highest priority problem statements from the research ideas submitted and allocates available research money. Research projects are selected for their anticipated results, potential value, and relevance to the industry. The selected problem statements are published as *research projects in development,* for which ACRP issues requests for competitive proposals. The winning proposal results in a contract to conduct the research and provide the ACRP with research results (data and analysis) in the form of project-appropriate *final deliverables.* The research results are then published and disseminated throughout the airport industry.

Since 2005, the AOC has allocated more than $86 million to 381 research projects, which have thus far resulted in nearly 200 publications. Table 3 summarizes the number of projects in each research field that have received research attention from the ACRP, along with the funds allocated to date.

The growing inventory of ACRP research results provides a body of work that can be periodically assessed in relation to the industry's need for knowledge and innovative practice. Such a self-examination can encourage fresh ideas to meet the challenges facing the industry. Accordingly, an evaluation of ACRP research results to date was made part of the AOC's effort to fine-tune the solicitation and evaluation of effective problem statements. Over time, a continuing assessment of ACRP research results

Table 3 ACRP research projects and funds allocated by research field.

	2005–2009		2010		2011		2012		2013		2014		Total	
Research Field	#	$	#	$	#	$	#	$	#	$	#	$	#	$
01–Administration	18	6,647,104	0	—	2	750,000	2	700,000	3	1,000,000	3	1,450,000	28	10,547,104
02–Environment	17	5,523,143	13	4,948,520	10	4,249,862	6	2,175,000	4	1,175,000	13	5,433,424	63	23,504,949
03–Policy and Planning	18	6,121,587	6	1,997,668	4	1,349,897	1	400,000	2	450,000	5	2,550,000	36	12,869,152
04–Safety	10	2,837,775	1	300,000	3	1,150,000	3	825,000	2	550,000	1	400,000	20	6,062,775
05–Security	1	298,459	0	—	0	—	0	—	1	350,000	0	—	2	648,459
06–Human Resources	2	247,386	0	—	0	—	0	—	0	—	0	—	2	247,386
07–Design	6	2,477,417	1	400,000	1	496,888	3	800,000	0	—	1	450,000	12	4,624,305
08–Construction	1	150,000	0	—	0	—	0	—	0	—	0	—	1	150,000
09–Maintenance	1	224,818	0	—	1	500,000	6	1,600,000	2	740,000	2	550,000	12	3,614,818
10–Operations	9	3,493,296	1	599,976	1	399,840	4	1,250,000	5	1,450,000	3	1,250,000	23	8,443,112
11–Special Projects	62	4,940,000	30	2,410,000	22	1,208,947	23	1,950,000	23	2,666,000	22	2,616,576	182	15,791,523
Total	**145**	**32,960,985**	**52**	**10,656,164**	**44**	**10,105,434**	**48**	**9,700,000**	**42**	**8,381,000**	**50**	**14,700,000**	**381**	**86,503,583**

is expected to yield a strategic analysis of gaps in knowledge and practice, helping direct how ACRP research anticipates and meets industry needs.

ACRP projects have always originated from problem statements submitted by grassroots sources within the aviation industry. The ACRP has previously considered adding an initiative to engage the AOC directly with others in the industry to identify and define one or more high-level emerging critical issues impacting, or soon to impact, the airport industry. The two initiatives launched by the AOC in 2012 were intended to expand upon this desire for an internal initiative and to reinforce the program's connection to industry practitioners and stakeholders, helping to ensure that future problem statements—and the resulting research projects—will target the emerging critical issues, impacting practitioners even more effectively.

SUBMISSION OF RESEARCH PROBLEM STATEMENTS THAT MATTER

The ACRP's effort to improve problem statements and their potential contribution to the airport industry involved two primary initiatives:

1. *Externally sourced research ideas:* Design/refine methods that would enable grassroots practitioners to author problem statements of improved quality and relevance to ACRP; and
2. *Internally sourced research ideas:* Design a collaborative process so that the AOC could identify one or more current or emerging issues of strategic importance in which ACRP could make meaningful contributions to the airport industry.

Implementation of the AOC's two initiatives required candid self-examination of how the ACRP has worked since its inception and how the maturing program can best continue to work in the future. This self-examination led to specific actions designed to strengthen the internal and external processes for obtaining problem statements and to encourage fresh, new ideas for research targeting current and emerging challenges facing the industry.

To invite submission of problem statements that matter, the ACRP added to and improved the available guidance for those seeking to submit ideas by revising the program's written guidance and adding PowerPoint and video presentations, all of which are now available on the web.

Guidance for Submission of Research Problem Statements

Immediately following the July 2012 AOC meeting, ACRP staff reviewed, refined, and expanded the program's written guidance for preparing problem statements. An updated guidance document, "How to Write an Effective Research Problem Statement," was issued in December 2012, in time for the solicitation of FY2014 problem statements. Focusing only on the required elements necessary for the problem statement to be effective, the new guidance document clarifies the rationale for each element and helps potential problem statement authors better understand the ACRP research process. The updated ACRP guidance document

- Provides an overview of ACRP;
- Describes the process by which ACRP research problem statements are generated, reviewed, and selected;
- Outlines general considerations in drafting a problem statement;
- Provides insight into critical considerations to aid the author in writing an effective problem statement, potentially generating research that can make greater contributions to the airport industry;
- Defines key elements that help determine whether a research idea is appropriate for ACRP; and
- Provides specific guidance for completing each section of the problem statement outline.

Figure 1 presents condensed highlights from the guidance document. The complete ACRP guidance for preparing problem statements is available on the web at: http://onlinepubs.trb.org/onlinepubs/acrp/ACRPProblemStatementoutline.pdf.

Outreach to the Aviation Community

To improve industry outreach and make the information even more accessible to potential problem statement authors, two additional tools were developed. The written guidance was distilled into a PowerPoint presentation, "Developing a Successful Problem Statement," which is suitable for delivery at industry events, and the information was recorded as an instructional webinar/video, along with segments in which ACRP staff and guests explain what elements of a problem statement are most effective in getting a research idea approved (see Figure 2 and Figure 3).

ACRP research ideas and problem statements come from many sources, but most often are submitted by airport industry practitioners. Guidance for those preparing a research problem statement for ACRP emphasizes the following points:

- Problem statements undergo consecutive levels of review, including:
  - An initial review by ACRP program officers, who check for potential overlap with other ACRP projects and comment on the suggested funding amount;
  - Assessment by one or more TRB aviation-related standing committees who provide feedback on the merits of each problem statement;
  - Examination by one or more review panels made up of industry practitioners, who evaluate each statement and make funding recommendations; and
  - A final review by AOC members of all the problem statements, culminating in a meeting at which the AOC members select which problem statements address the most pressing issues and will produce the most useful research results for the airport community.
- Not all research ideas are appropriately addressed by ACRP. The best problem statements address how the proposed research will:
  - Directly benefit numerous airports or groups of airports;
  - Result in findings airports can successfully implement, ideally within the near term (e.g., within 5 years);
  - Address existing literature, closing existing knowledge gaps by adding to or updating the body of knowledge in the industry;
  - Be completed within a specified budget (typically $300,000 to $500,000) and timeframe (typically within 12 to 24 months); preferred ACRP projects focus on small, solvable problems;
  - Use a feasible research approach that can be successfully executed to produce the desired results; and
  - Avoid promoting a particular practice or product; although the completed research may result in objective recommendations for best practices, the problem statement cannot be designed to promote a specific product.
- Furthermore, the most compelling problem statements will:
  - Effectively and succinctly communicate the research idea and research objectives within one or two clearly written pages;
  - Convey enough background and explanatory information to enable reviewers of various industry backgrounds to understand and appreciate what is being proposed, including tasks, estimated research time and budget, and related research;
  - Address the industry's need for and potential benefits of the proposed research;
  - Identify whether the problem statement is the product of an individual, multiple individuals, a formal committee, or other entity; and
  - Provide the name, title, and contact information of the lead individual submitting the problem statement, as well as the submission date.

The ACRP Guidance for Preparing Problem Statements document includes additional suggestions for creating a problem statement title, structuring the background section, concisely presenting the objective, developing the estimate of funding needs and research duration, identifying knowledge gaps in related research, and maximizing the chance that a problem statement will be selected.

Figure 1 A snapshot guide to ACRP problem statements.

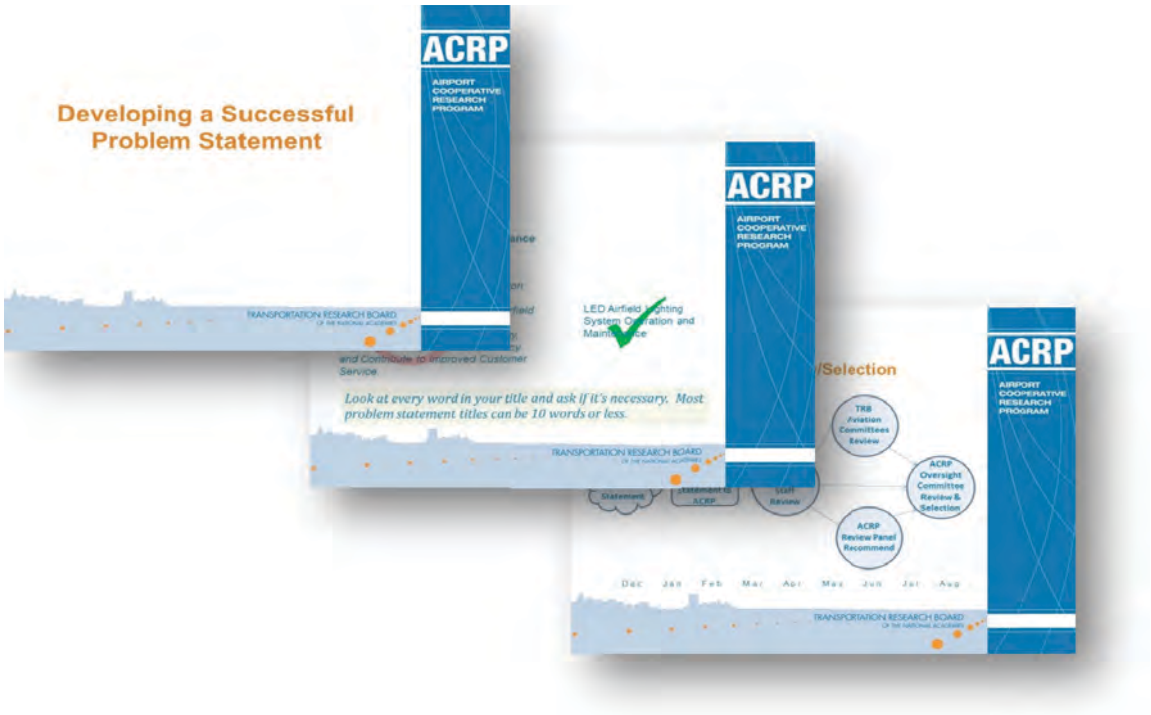


Figure 2 PowerPoint: "Developing a Successful Problem Statement."

Figure 3 Screenshot from ACRP video, "Developing a Successful Problem Statement."

The PowerPoint slides and the instructional video are available for download from the World Wide Web by clicking on the following links:

- http://onlinepubs.trb.org/onlinepubs/acrp/Problem Statement Guidance Revised-mrs.pdf
- https://vimeo.com/64584244

INVENTORY OF ACRP'S PUBLISHED RESEARCH

An inventory of ACRP's published research was seen to be the first step toward identifying research gaps that may exist in practical knowledge and innovative practice for airports. Creation and analysis of such an inventory would also help identify and highlight existing research that can help practitioners throughout the airport industry.

To address this part of the AOC's initiative, the research team analyzed the published results of 7 years of ACRP research, including project reports, synthesis reports, research results digests (RRDs), legal research digests (LRDs), impacts on practice (IOPs), and web-only documents (WODs). The inventory required thoughtful design, and early emphasis was placed upon the effort's sustainability, utility, and ideas for innovative communication of results.

Apart from Special Projects, the ACRP recognizes 10 distinct research fields. Because each field may comprise several relevant subject areas, the growing ACRP research library could be categorized into more than 100 subject areas. Given the focus and priorities of the AOC initiative, and finite resources available, it was decided to limit the initial inventory to approximately 30 subject areas, called *sub-topics*, distributed across four of the 10 research fields. In July 2013 the AOC authorized continuation of this project. Accordingly, the continuing inventory (i.e., the remaining research fields and their myriad sub-topics) will be addressed in 2014.

Initial Inventory (conducted in 2013 and included in this digest)

- ACRP Research Field 2—Environment (Water);
- ACRP Research Field 3—Policy and Planning;
- ACRP Research Field 6—Human Resources; and
- ACRP Research Field 10—Operations (Airside).

Continuing Inventory (to be conducted in 2014/2015)

- ACRP Research Field 1—Administration;
- ACRP Research Field 2—Environment (Air);
- ACRP Research Field 2—Environment (Noise);
- ACRP Research Field 4—Safety;
- ACRP Research Field 5—Security;
- ACRP Research Field 7—Design;
- ACRP Research Field 8—Construction;
- ACRP Research Field 9—Maintenance; and
- ACRP Research Field 10—Operations (Landside).

ACRP staff, the project team, and a select group of experienced professionals collaborated to develop and define a list of sub-topics within each of the selected ACRP research fields in the initial inventory, thus organizing the subject matter that practitioners might expect to find in the existing body of research. The team also identified keywords to further define each topic, forming an outline for the four research fields. Next, the published ACRP literature was examined and placed within one or more of the identified sub-topics. Next, the research team conducted a second-level review, evaluating the topic/sub-topic assignments and classifying each publication by agreed-upon measures that addressed four evaluation criteria developed for this inventory: volume of work, context, organizational role, and resource type. More specifically, each publication was classified in terms of

- **Volume of Work.** Describes whether a topic was covered through the entire book or document (project report, synthesis, etc.), in a single section or chapter, or simply mentioned on a page or two.

Table 4 Sample publications classified using volume of work criteria.

Environment—Water (Potable Water)				
Resource	**Title**	**Page**	**Chapter**	**Book**
ACRP Report 5	Quarantine Facilities for Arriving Travelers: Identification of Planning Needs and Costs	X		
ACRP Report 42	Sustainable Airport Construction Practices	X		
ACRP Report 43	Guidebook of Practices for Improving Environmental Performance at Small Airports		X	
ACRP Report 80	Guidebook for Incorporating Sustainability into Traditional Airport Projects		X	

  - **Page.** The topic is addressed on one page or a series of pages, but is not an entire section or chapter of the document.
  - **Chapter.** An entire section or chapter of a document is dedicated to the topic.
  - **Book.** An entire document is dedicated to the topic.

Table 4 presents a sampling of publications classified by volume of work. The sample publications in the table are from ACRP Research Field 2—Environment, within the topic Water and the sub-topic Potable Water.

- **Context.** Indicates whether the document addresses subjects that are on the airside, landside, at the terminal, off-airport, and/or organizational (within the airport organization). Context provides one way to identify audience, and the context remains consistent throughout the inventory so that all publications have a comparable context.
  - **Airside.** Includes all areas accessible to aircraft, such as runways, taxiways, hangars, and ramps.
  - **Landside.** Includes the areas before a security checkpoint, such as parking lots, public transportation stations, and access roads.
  - **Terminal.** Includes the terminal building as well as the associated curbside area in front of the terminal (between airside and landside).
  - **Off-Airport.** Includes areas that are not on airport-owned property, such as adjacent property, areas that are scheduled to become airport property, areas that may be privately held with airport-related uses, or areas related to a municipal entity or community.
  - **Organizational.** Includes items that may apply to an airport organization as a whole and not to individual facilities (i.e., strategic planning).

Table 5 presents a sampling of publications classified by context. These sample publications are drawn from ACRP Research Field 3—Policy and Planning, within the sub-topic Airport Planning.

- **Organizational Role.** Indicates who would most likely use the document as a resource. The categories are management, technical, trainee, and external. These categories are another way to identify audience and remain consistent for all publications. The external category can be broadly defined as groups

Table 5 Sample publications classified using context criteria.

Policy and Planning—Airport Planning						
Resource	**Title**	**Airside**	**Terminal**	**Landside**	**Off-Airport**	**Org.**
ACRP LRD 14	Achieving Airport-Compatible Land Uses and Minimizing Hazardous Obstructions in Navigable Airspace				X	X
ACRP Report 16	Guidebook for Managing Small Airports	X	X	X	X	
ACRP Report 17, Volume 1	Airports and the Newest Generation of General Aviation Aircraft	X	X			
ACRP Report 25, Volume 1	Airport Passenger Terminal Planning and Design	X	X	X		

including the airport board, local elected officials, community members, and consultants.

- **Management.** Includes airport managers or directors, chief executive officers (CEOs), and higher level managers—the people who are ultimately responsible for the day-to-day management of an airport.
- **Technical.** Includes the individuals who take action with responsibility for one (or more) facet(s) of an airport, such as engineers, planners, or other staff members. This category can include airport managers and leaders as well.
- **Trainee.** Includes individuals who are new to the industry or who have limited experience, including new hires and entry level staff.
- **External.** Includes the stakeholders who are linked to an airport but who are not paid employees of the airport. This category can include members of commissions or boards; local municipalities, politicians, or related groups (chambers of commerce, adjacent businesses, etc.); and the general public. These stakeholders have varying levels of insight and input on an airport, but they are not employed by the airport.

Table 6 presents a sampling of publications classified by organizational role. These publications are drawn from ACRP Research Field 6—Human Resources, within the sub-topic Organizational Structures.

Table 6 Sample publications classified using organizational role criteria.

Human Resources—Organizational Structures					
Resource	**Title**	**Mgmt.**	**Technical**	**External**	**Trainee**
ACRP Synthesis Report 19	Airport Revenue Diversification	X			
ACRP Synthesis Report 40	Issues with Airport Organization and Reorganization	X		X	
ACRP Report 16	Guidebook for Managing Small Airports	X			X
ACRP Synthesis Report 31	Airline and Airline–Airport Consortiums to Manage Terminals and Equipment	X			
ACRP Report 66	Considering and Evaluating Airport Privatization	X		X	

- **Resource Type.** Takes inventory of the type of document or resource (e.g., project report, synthesis of practice, RRD, LRD, WOD, IOP, or electronic tool). Some projects produce more than one resource.
  - **Project Report.** The main product of the ACRP research process; may be written as a resource document, guidebook, or manual.
  - **Synthesis.** A report on the current state of the practice based on literature reviews and surveys of recent activities in critical areas. Synthesis reports also inform airport managers about innovations being used by others to solve problems.
  - **Legal Research Digest.** A report on a timely legal issue, compiled case law, or suggested specific solutions to specific legal problems. LRDs usually are 50 pages in length or less.
  - **Research Results Digest.** A report that is used to promote early awareness of project results in order to encourage implementation. RRDs also summarize specific findings that emphasize how the research may be used. The contents are organized in terms of the problem and the solution to it, the findings, and the applications. RRDs usually are 30 pages in length or less.
  - **Web-Only Document.** Typically a fully searchable PDF of contractor-prepared reports or supporting appendix materials. WODs are linked to other project-related products, as well as to the relevant project write-ups.
  - **Impacts on Practice.** One or more of a series of brief documents designed to provide examples of how airport industry practitioners are using ACRP research results to assist them in their work.
  - **Tool.** A resource that provides the reader with a specific process, tool, workbook, etc., to create an end product. This may be included in a project report or synthesis and is not necessarily a standalone element from the other ACRP documents.

Table 7 presents a sampling of publications classified by resource type. These publications are drawn from ACRP Research Field 10—Operations, within the sub-topic Airfield Inspection and Maintenance.

Any publication could be classified under several different fields, topics, and sub-topics, and could meet a variety of the categorizing criteria. Reports classified within the same topic could fill different parts of the research inventory, either by

Table 7 Sample publications classified by resource type.

Operations—Airfield Inspection & Maintenance								
Resource	**Title**	**Tool**	**PRJ**	**SYN**	**LRD**	**RRD**	**WOD**	**IOP**
ACRP Synthesis Report 11	Impact of Airport Rubber Removal Techniques on Runways			X				
ACRP Synthesis Report 35	Issues With Use of Airfield LED Light Fixtures			X				
ACRP Report 16	Guidebook for Managing Small Airports		X					
ACRP Report 72	Guidebook for Selecting Methods to Monitor Airport and Aircraft Deicing Materials		X					

PRJ = Project Report; SYN = Synthesis Report; LRD = Legal Research Digest; RRD = Research Results Digest; WOD = Web-Only Document; IOP = Impacts on Practice document.

addressing the topic at a different level of detail or by addressing a different audience. Because the framework allowed the team to consider more than one classification, the data review provided a multifaceted description of the ACRP's published research results that could be demonstrated through the various categories.

The research team analyzed each ACRP publication by the depth of knowledge and practice it contributed to the sub-topic, the airport or aviation stakeholders it was designed to reach, and the organizational context for the research. In total, 181 publications were inventoried: 83 project reports, 39 synthesis reports, 17 RRDs, 19 LRDs, 14 WODs, and 9 IOPs.

This digest presents the results of the initial inventory covering 30 sub-topics in four of ACRP's 10 major research fields. Once again, it is expected that information will be gathered about ACRP's published research literature in the remaining research fields during the coming year and beyond. As each phase of the inventory is completed, all inventory results will be made available for viewing or download at http://www.trb.org/acrp/acrp.aspx.

The inventory was completed using a spreadsheet format in which the raw data was summarized through a brief narrative text and a graphic scorecard. For each sub-topic, the summary provides a simple introduction and notes the most significant features of the volume, context, organizational role, and resource type—and the availability of tools as applicable. This commentary also addresses whether a given sub-topic has been researched extensively by ACRP and whether other research is likely to be available through other industry organizations and includes observations about potential gaps in the available body of research (recognizing that, in some cases, the research may come from other sources). For some sub-topics, suggestions for problem statement topic areas have been included in the commentary.

In the sections that follow for each sub-topic addressed, a summary is provided and a scorecard that compiles information in a graphic format. Within the scorecards, types of research projects are summarized using icons of book covers. Tools are represented by a wrench. The volume of work is summarized using blocks of varying shades and sizes. Context is represented using subdivided pie charts. The four audiences examined are represented by shaded circles that vary by scale and location based on the volume of resources that applies to each audience. This at-a-glance approach provides a meaningful, immediately useful summary of the aviation-specific research commissioned and carried out by ACRP to date.

ACRP Research Field 2—Environment (Water)

The topic of water at airports covers a relatively diverse range of subjects, from drinking water supplies, to stormwater quantity and quality, to the living resources in aquatic systems that may be affected by airport operations. The research needs of the water sub-topics depend greatly on how available and applicable information is from other sources.

As an example of one extreme, the sub-topic of groundwater shares essentially the same technical and regulatory environmental issues across a wide range of settings. As a result, airports are able to readily draw upon and apply the global research and information resources that already exist in addressing groundwater issues.

At the other extreme, the sub-topic of deicing involves practices and technologies employed to contain and manage stormwater runoff from aircraft and airfield pavement deicing operations to meet environmental requirements. The types of deicing materials and operations that are conducted at airports are entirely unique

to this industry, and as a result, meeting the knowledge and information needs of the aviation community has required specialized research.

The other sub-topics fall somewhere between the two ends of the spectrum, where research and information from non-airport contexts is applicable, but specialized research is still required to address aspects of the topic that are unique to airports. Examples include general stormwater management, water supply and conservation, potable water systems, wastewater, water monitoring and assessment, and aquatic resources.

In ACRP Research Field 2—Environment under the topic of water, the sub-topics identified and used for classification include:

- Deicing,
- Stormwater,
- Water supply and conservation,
- Potable water,
- Groundwater,
- Wastewater,
- Water monitoring and assessment, and
- Aquatic resources.

Initial characterizations of ACRP research conducted in each of these sub-topics are presented in the discussions that follow, including preliminary identification of potential future research needs.

Environmental—Water | Deicing

This sub-topic includes topics related to understanding and managing the environmental implications of aircraft and airfield deicing operations. Also included are controlling deicing runoff through improved deicing practices, and runoff collection, storage, treatment, and discharge technologies and practices. This sub-topic does not include aspects of aircraft and pavement deicing that are not related to environmental concerns. The scorecard for deicing is presented as Figure 4.

Summary. Deicing research is focused on understanding and managing the environmental implications of aircraft and airfield deicing operations. It also includes controlling deicing runoff through improved deicing practices, and runoff monitoring, collection, storage, treatment, and discharge technologies and practices. The audience includes airport staff and consultants, airlines, environmental regulators, and environmental interest groups.

The literature in this category includes seven project reports, two synthesis documents, two WODs, and one research digest. Five of these documents include tools. The most comprehensive treatments of this topic are in *ACRP Report 14: Deicing Planning Guidelines and Practices for Stormwater Management Systems; ACRP WOD 3: Formulations for Aircraft and Airfield Deicing and Anti-Icing: Aquatic Toxicity and Biochemical Oxygen Demand;* and *ACRP WOD 8: Alternative Aircraft Anti-Icing Formulations with Reduced Aquatic Toxicity and Biochemical Oxygen Demand.* Most of the resources focus completely on this topic area and were predominantly written for a technical audience, although some also have applicability to management and external audiences. The context is diverse, but primarily airside, which is consistent with the nature of deicing as an airside operation.

Observations. Deicing-related research and synthesis projects have gotten a lot of coverage within the water topic. Of the 12 published reports, approximately 67%

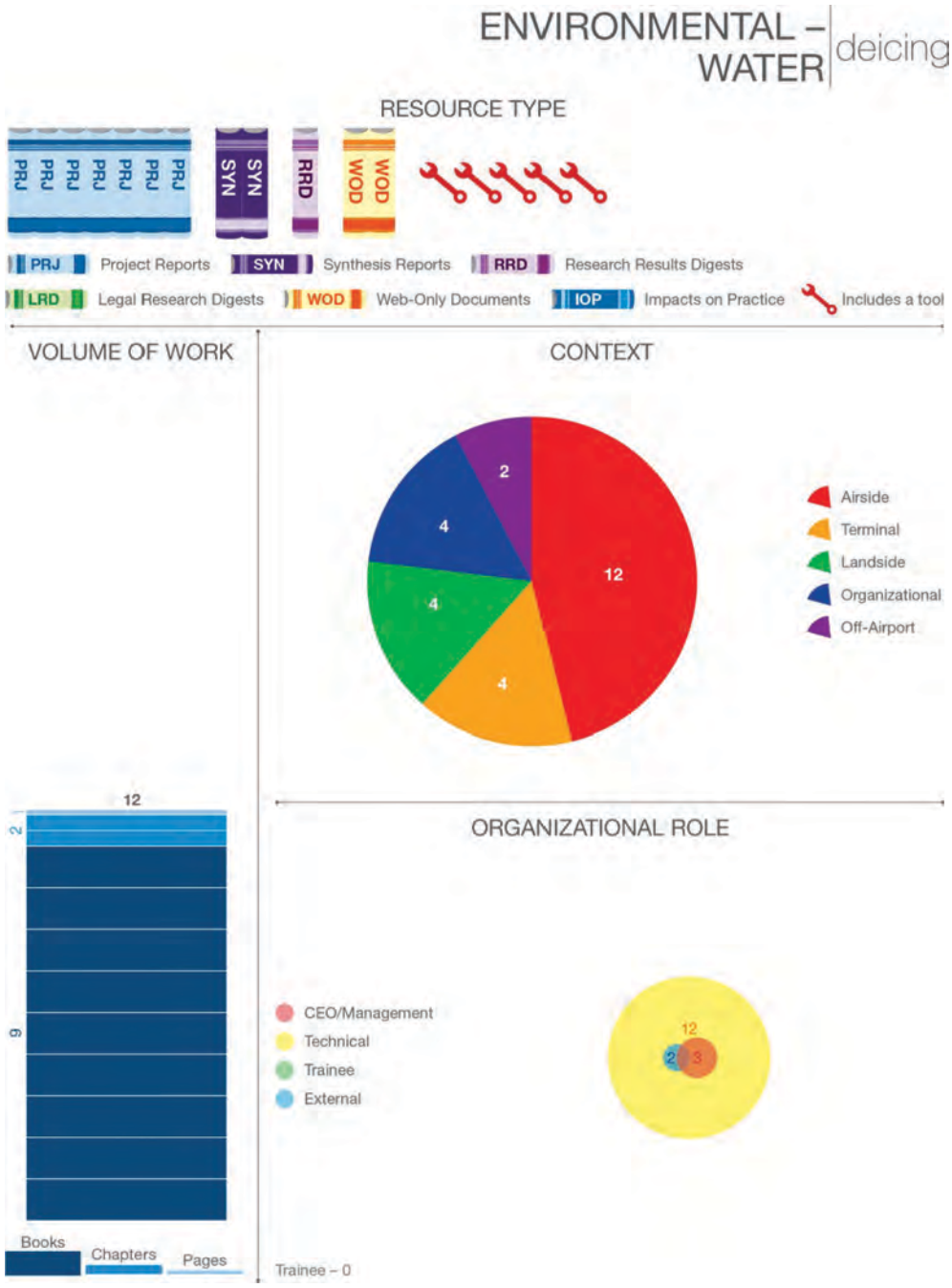


Figure 4 Scorecard—deicing.

concern deicing issues. This sub-topic is also very closely related to others within the water topic. For example:

- Nine of the 13 projects that cover stormwater do so in the context of deicing runoff.
- Deicing was a significant driver for research on wastewater management and treatment, with 57% of those projects being directly related to disposal of deicing runoff.
- Similarly, two of the four projects that address aquatic resources issues in some fashion are focused primarily on deicing.

- Both of the monitoring and assessment research projects are driven by deicing issues.

These observations are consistent with and reflect the industry's need for information and guidance regarding deicing in response to increasing regulatory pressure for controlling discharges of deicing stormwater, and especially the EPA's development of national Effluent Limitation Guidelines for aircraft and airfield deicing runoff.

Future research needs are likely to include periodic updates of existing guidance documents to reflect continual evolution in deicing practices technology and environmental concerns, and research that may be required in support of the aviation industry's Voluntary Pollution Reduction Program.

Environmental—Water | Stormwater

This sub-topic includes issues related to all aspects of stormwater management at airports, including industrial, municipal, and construction stormwater. The scorecard for stormwater is presented as Figure 5.

Summary. All aspects of stormwater management at airports are grouped in this sub-topic, including the industrial, municipal, and construction stormwater categories. Subjects include wildlife attraction, sustainability, and climate change adaptation. The audiences include airport staff and consultants, airlines, environmental regulators, and environmental interest groups.

The literature in this category includes seven project reports, four synthesis reports, one research digest, and one WOD. Six of these research publications include tools. Deicing issues are directly or indirectly addressed in much of the stormwater research, and as with that sub-topic, the documents are written for a technical audience. However, the stormwater research has broader applicability to management/CEO and trainee audiences. The context of stormwater research is diverse, with airside and landside being the primary two contexts, which is consistent with the issues associated with stormwater management.

Observations. A majority of the projects that cover stormwater do so in the context of deicing runoff. This emphasis reflects the fact that deicing presents a stormwater management challenge that is unique to airports. Other aspects of airport stormwater management are shared with other types of industries and facilities, so airports can draw on a wealth of information resources developed by others.

The ACRP stormwater management research that is unrelated to deicing is limited to wildlife hazard management and sustainability.

Areas of potential future research needs include:

- Guidance for airports in responding to emerging stormwater regulations and environmental concerns regarding post-construction stormwater;
- Site-specific pollutant issues; and
- Interpretation of stormwater monitoring data.

Environmental—Water | Water Supply and Conservation

This sub-topic includes topics related to the use and conservation of water resources at airports. Also covered are both potable and non-potable water sources in the context of conservation, stormwater harvesting, landscape irrigation, toilets, low-flow faucets, cleaning operations, and other similar topics. This sub-topic does

Figure 5 Scorecard—stormwater.

not include groundwater resources or the quality of potable and non-potable water at airports. The scorecard for water supply and conservation is presented as Figure 6.

Summary. Water supply and conservation research covers the use and conservation of water associated with domestic, industrial, and landscape uses at airports. The audience includes airport management and technical/professional staff and consultants.

The ACRP literature in this category includes two project reports and one synthesis document. Two of these documents include tools.

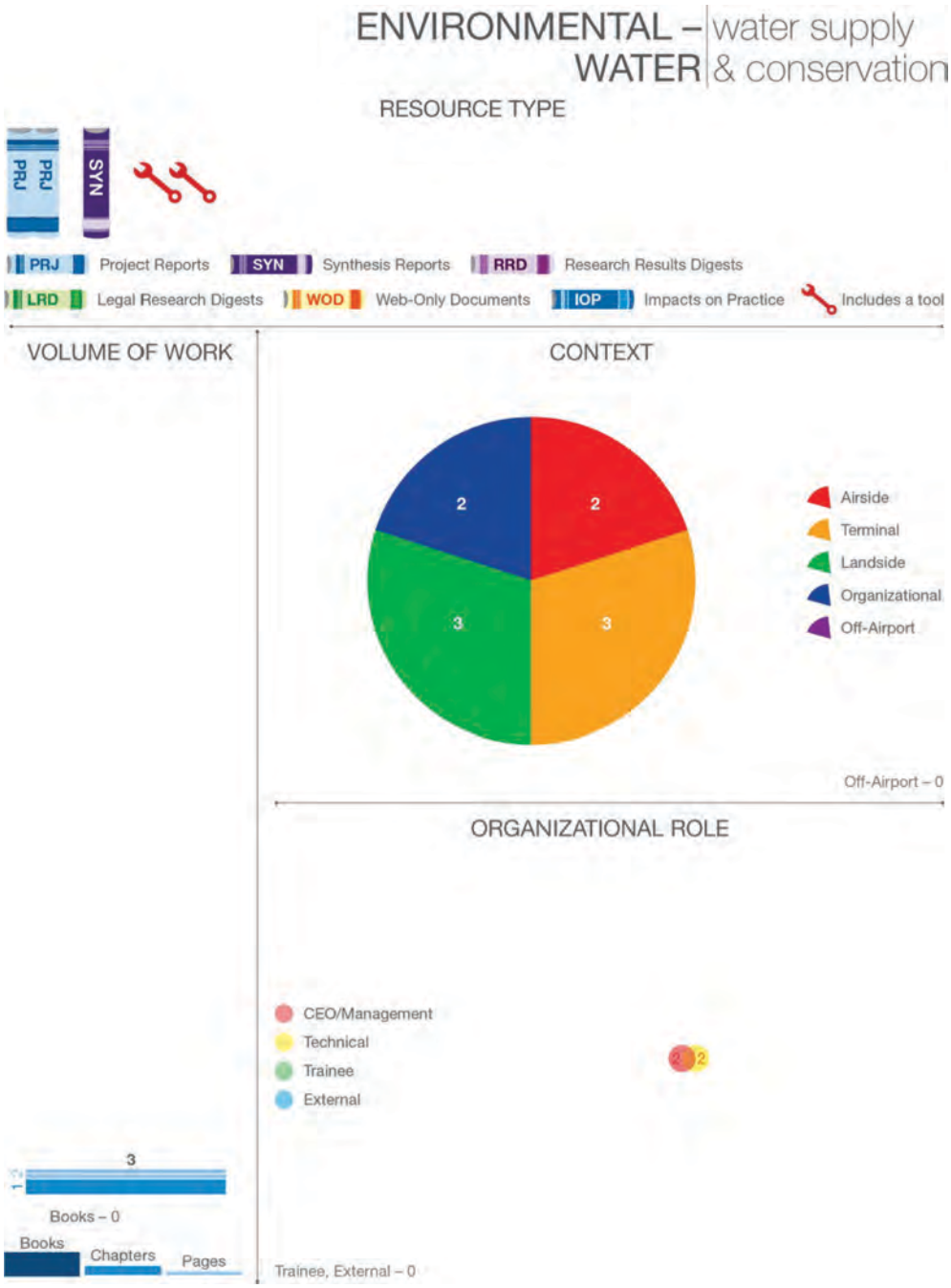


Figure 6 Scorecard—water supply and conservation.

Observations. All of the ACRP research concerning water conservation addresses the sub-topic as part of one of the larger topics of sustainability or airport contracts. The relatively limited coverage of this sub-topic reflects the substantial volume of information on water conservation practices that has been developed by other industries, and which can generally be applied in the airport context.

Despite of the information available from other sectors, there is a need to better understand the principles of water conservation, the options that are available in an airport context, and the process by which a practical and effective airport water

conservation program can be built and implemented. Accordingly, the following preliminary list of research needs in this sub-topic has been identified:

- Develop industry guidance on planning water conservation efforts tailored to aviation facility-specific context and needs.
- Establish industry metrics for setting goals and assessing progress of water conservation efforts.
- Provide guidance on methods to quantify and track water usage in an airport context.

Environmental—Water | Potable Water

This sub-topic includes the issues surrounding the distribution and safety of potable water sources at airports and to aircraft. The scorecard for potable water is presented as Figure 7.

Summary. Potable water is a sub-topic that relates to the quality of potable water in airports, including water taken on by aircraft from airport potable water lines. The audience consists of airport management and technical/professional staff and consultants. The literature addressing this sub-topic consists of four project reports, three of which contain tools.

Observations. The ACRP research literature has covered potable water issues as one part of the larger context of various topics including sustainability, environmental performance, and planning for quarantine facilities. Only the latter context provides in-depth coverage.

Although future research needs in this area are uncertain at the current preliminary level of analysis, one area of potential research need is the development of guidance for airports in the regulatory and technical aspects of managing potable water supplies for aircraft, including best practices.

Environmental—Water | Groundwater

This sub-topic covers content related to assessment, protection, and mitigation of groundwater resources associated with airport property and operations. The scorecard for groundwater is presented as Figure 8.

Summary. Groundwater relates to the quality of groundwater resources. This subcategory focuses on groundwater impacts from airport activities, particularly accidental releases of fuels and other products that could contaminate groundwater. The audience is technical airport staff.

The ACRP research literature in this category consists of one project report addressing the general subject of water resources issues associated with airport development planning. The project includes a tool.

Observations. The coverage of groundwater quality in ACRP research is very limited. This situation reflects the large volume of information generally available on the topic from sources outside of ACRP that is directly applicable to addressing groundwater quality in an airport context. Although future research needs in this area are uncertain at the current, preliminary level of analysis, one area of potential research need is the investigation of special requirements associated with groundwater assessment and remediation projects in an airport/airfield context.

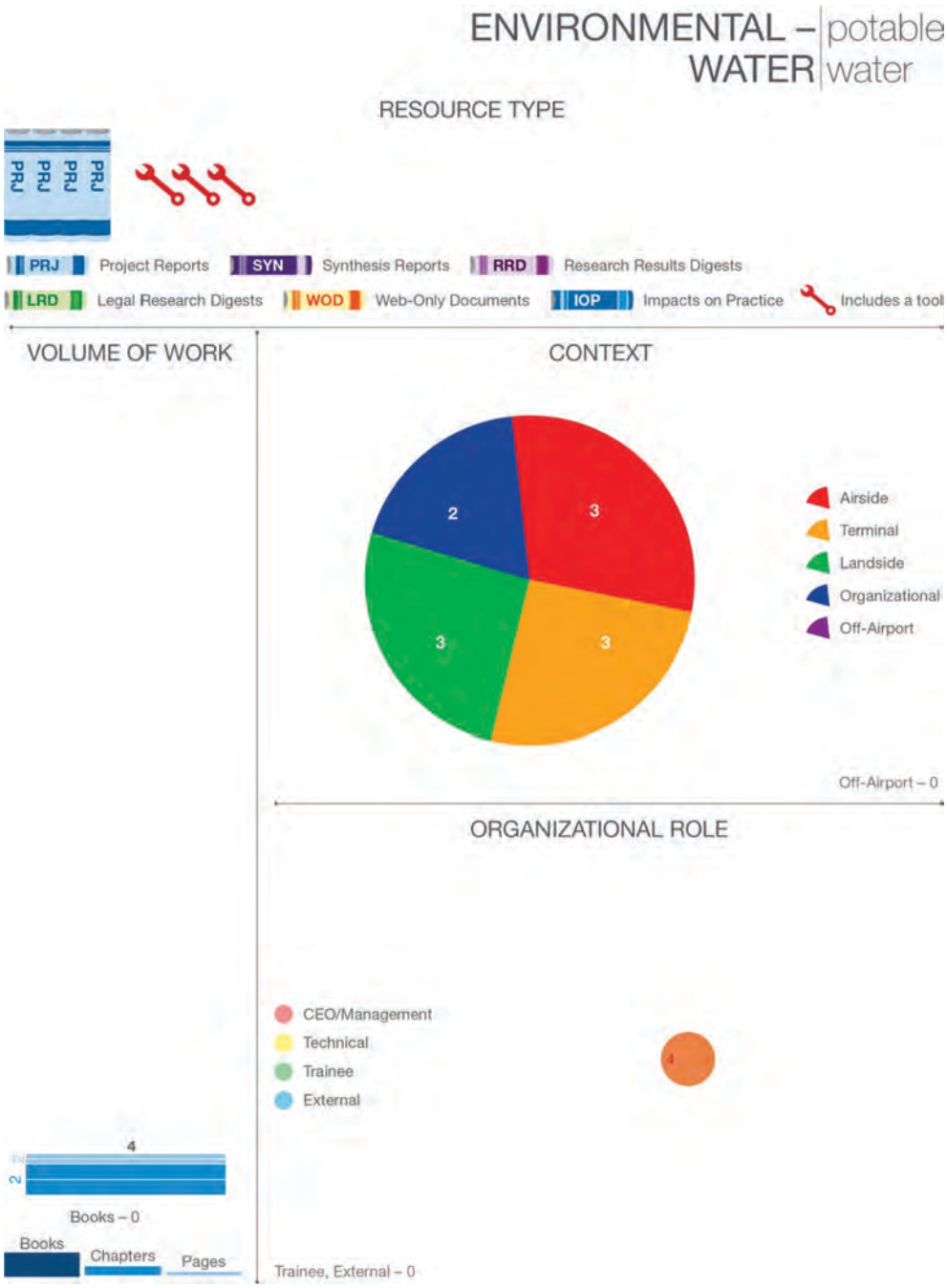


Figure 7 Scorecard—potable water.

Environmental—Water | Wastewater

This sub-topic includes topics related to the treatment, disposal, or recycling of wastewaters generated by airport facilities and activities, such as toilets, aircraft and vehicle maintenance, and other industrial activities. The scorecard for wastewater is presented as Figure 9.

Summary. Wastewater covers the treatment and disposal of domestic and industrial wastewater generated by airport operations. It includes sanitary sewerage and stormwater runoff impacted by aircraft and airfield deicing operations. The con-

Figure 8 Scorecard—groundwater.

text addresses airside, terminal, and landside areas and organizational issues in fairly equal proportion. The audience predominantly consists of management and technical/professional staff, but includes external sectors in one instance.

The ACRP research literature in this category consists of seven project reports, six of which include tools. The volume of work ranges from whole books to chapters to pages. Three of the reports address wastewater treatment in the specific context of deicing runoff management, while the others have a broader context.

Observations. The most detailed coverage of this sub-topic is in the context of treating airport deicing runoff, which reflects the relative uniqueness of this context

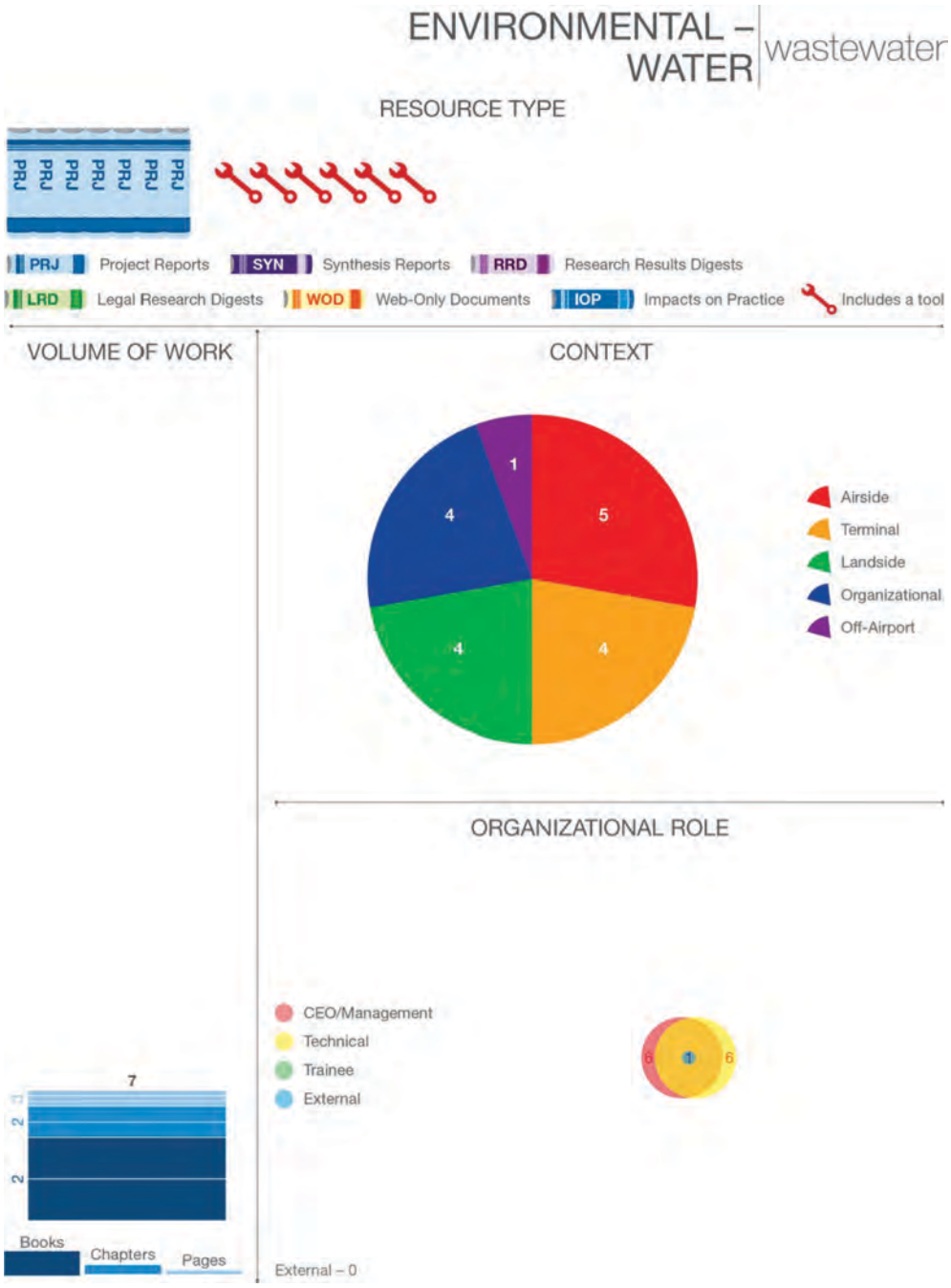


Figure 9 Scorecard—wastewater.

to airports as a wastewater issue. This sub-topic has some overlap with the water conservation sub-topic.

Areas of potential research need identified at this preliminary level of assessment include:

- Guidance for airports in developing contractual agreements with wastewater treatment plant operators, glycol recyclers, and other wastewater disposal providers, and
- Strategies for airports to optimize the use of available capacity at publicly-owned treatment works (POTWs).

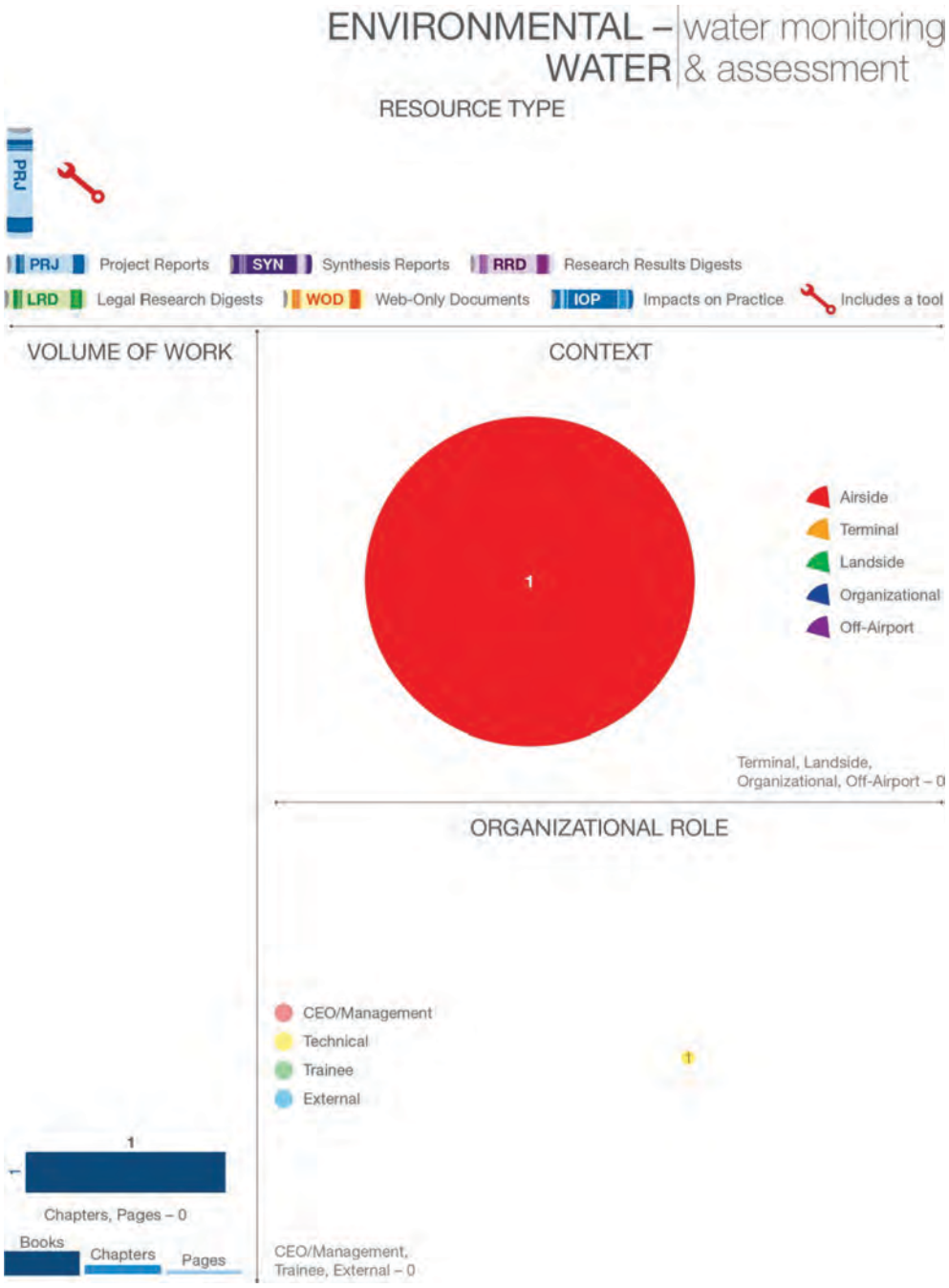


Figure 10 Scorecard—water monitoring and assessment.

Environmental—Water | Water Monitoring and Assessment

Water monitoring and assessment includes research related to collecting and interpreting measurements of water quality and flow in various contexts at and adjacent to airports to support environmentally relevant objectives. The scorecard for water monitoring and assessment is presented as Figure 10.

Summary. Research on water monitoring and assessment covers measuring water quality and flow of various streams at an airport. It includes stormwater, wastewater, industrial water supplies, and potable water.

The literature in this category consists of one project report that includes a tool for selecting appropriate monitoring technologies. The audience for this work is professional airport staff and consultants.

Observations. Although the general science and practice of monitoring water quality and quantity is well documented in the literature, the objectives and constraints on monitoring various water streams in the airport context are somewhat unique because of the industrial activities at airports. This uniqueness especially applies to monitoring associated with deicing operations and runoff management, and is reflected in the fact that the single ACRP research document on this sub-topic is specific to deicing.

There appears to be a need for guidance on the interpretation of airport water quality sampling results. Guidance in this area would complement the existing general guidance on water quality monitoring, as well as the ACRP guidance on monitoring in the context of deicing.

Environmental—Water | Aquatic Resources

Includes subjects related to living resources that exist in aquatic environments that are affected by airport operations. This topic does not include the water resources aspect of such aquatic environments. The scorecard for aquatic resources is presented as Figure 11.

Summary. Aquatic resources research relates to living resources associated with aquatic environments at or adjacent to airports. It includes fish and other biota in receiving waters, as well as wildlife that are associated with open-water features. The audience is technical and professional staff and consultants, and for two publications the audience also includes off-airport interests.

The ACRP literature in this category consists of one project report, one WOD, one synthesis document, and one RRD. Three of the four works are fully devoted to the topic. The project report includes tools.

Observations. Three of the four ACRP documents also fall into the deicing subtopic, reflecting the concerns about the impacts of deicing on aquatic resources in receiving waters. Although future research needs in this area are uncertain at the current, preliminary level of analysis, one area of potential research need that was identified is regulatory guidance for airports in dealing with narrative water quality standards, including those that apply to problematic biofilm growth associated with stormwater discharges that contain deicers.

ACRP Research Field 3—Policy and Planning

This research field is very large in scope. Given that planning is required for the implementation of new systems, new infrastructure, new policies, and other actions, it is addressed in a large portion of ACRP resources. Some documents address planning on a large scale, such as strategic planning or system planning. Other publications have a much narrower focus, such as planning for offsite airport terminals or implementing automated people mover systems at airports.

The sub-topics identified and used within ACRP Research Field 3—Policy and Planning include:

- Physical infrastructure and buildings,
- Airport management,

Figure 11 Scorecard—aquatic resources.

- Airport financial management,
- Economic development and revenue generation,
- Airport planning,
- Sustainability,
- Public relations and communications, and
- Safety management systems (SMS).

The volume of research ranges from a few pages to entire books related to planning and policy. The context of these resources is evenly spread across all areas of an

airport, including airside, terminal, landside, and off-airport, as well as an airport's organization as a whole. By nature, planning efforts are usually the responsibility of airport management and technical staff; however, they are not usually geared toward individuals who would fit into the trainee category. Of the seven resource types cataloged, the majority of the policy and planning resources are project reports.

Policy and Planning | Physical Infrastructure and Buildings

Physical infrastructure and buildings covers subjects related to the physical development of airport infrastructure, including terminals, aircraft rescue and fire fighting (ARFF) buildings, snow removal equipment (SRE) buildings, and maintenance buildings. The scorecard for physical infrastructure and buildings is presented as Figure 12.

Summary. Physical infrastructure and buildings covers knowledge and practice related to the physical development of airport infrastructure, such as terminals, ARFF buildings, SRE buildings, and maintenance facilities.

Of the more than 150 resources reviewed by the project team, nearly 30 were classified within this sub-topic, including works on terminals, quarantine facilities, people mover systems, common use facilities, parking, aircraft arresting systems, airport pavements, and wayfinding and signage. In addition to the published resources, an additional 12 active or pending projects will yield research results likely to be classified here.

From a policy and planning viewpoint, this grouping appears to be well balanced in terms of the volume of work and resource types available. Four tools were noted in the inventory. Contextually, the majority of the published resources are related to terminal building design. These documents have been written mainly for management; however, several publications have been written for the technical/professional and external audiences.

Observations. The project team suggests that ACRP research continue to address the development of infrastructure from a planning standpoint, because planning efforts are critical for financial and operational success. Based on this initial inventory, it appears that an expanded focus on infrastructure other than terminal buildings, (e.g., international travel facilities and ARFF buildings) may be warranted.

A resource on facility design standards also would likely be useful for the management, technical/professional, and external audiences. This type of document would require updating every few years to address changing industry practices, especially updated guidance related to the revision of FAA's Advisory Circular (AC) 150/5300-13, *Airport Design* (now AC 150/5300-13A).

Additional research is suggested in the following areas:

- Creating healthy terminal environments (healthy food choices, exercise opportunities, and health resources),
- Funding for airport terminal design and construction,
- Accommodating special traveler needs, and
- Passenger experience at the airport—standard versus ultra-low-cost facilities.

Policy and Planning | Airport Management

Includes subjects related to airport management except for those focused on financial management: economic analysis and budgeting decisions. Risk manage-

Figure 12 Scorecard—physical infrastructure and buildings.

ment subjects are not addressed in this section. The scorecard for airport management is presented as Figure 13.

Summary. Airport management research covers the knowledge and practice related to traditional airport management, not including resources focused on the financial management, economic analysis, and/or budgeting decisions of an airport, or risk management. Resources related to financial management responsibilities are cataloged under another sub-topic, airport financial management.

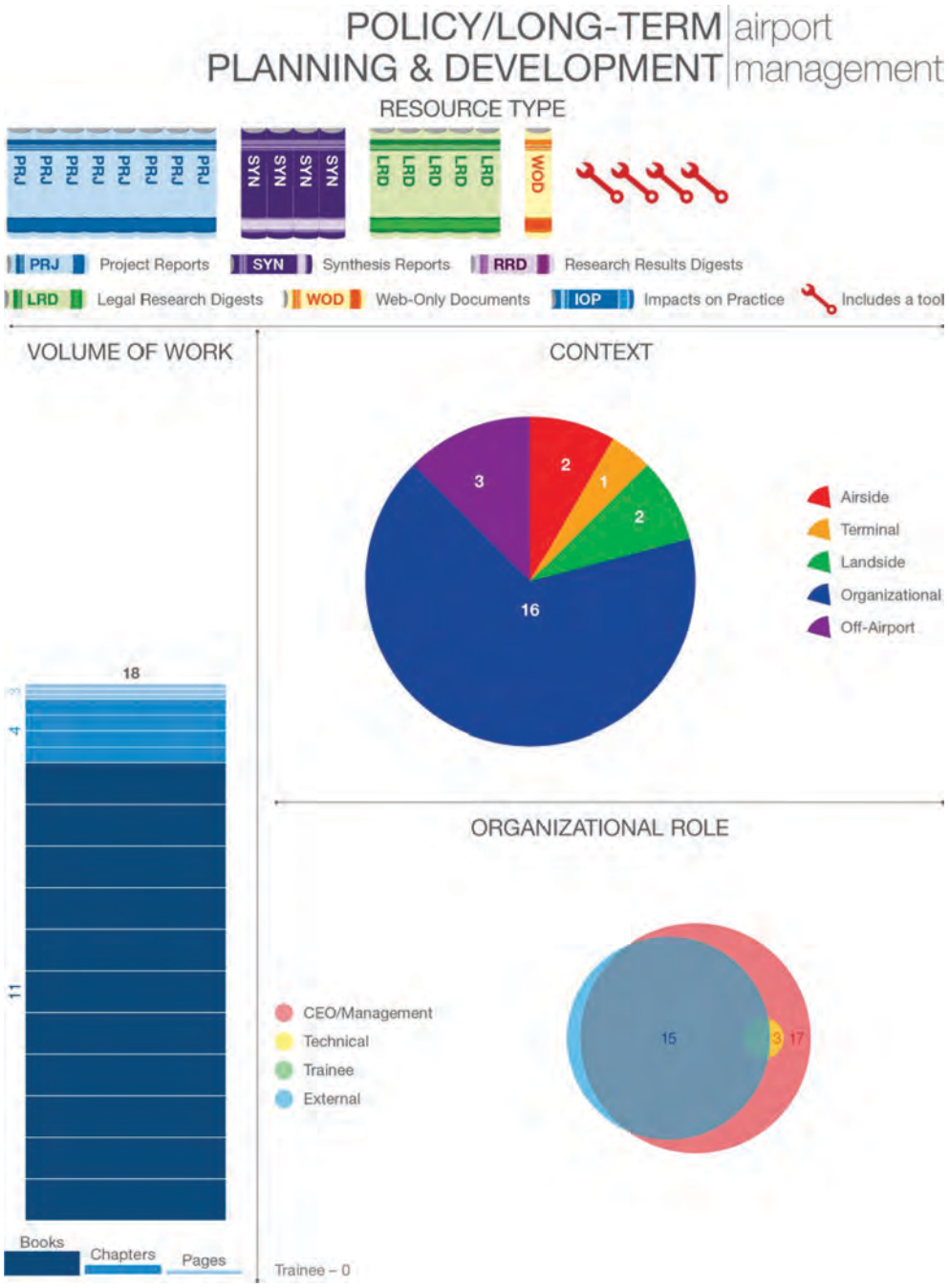


Figure 13 Scorecard—airport management.

Numerous ACRP publications were classified within this sub-topic. Nearly 20 published ACRP resources and another 20 active and pending projects relate to airport management at some level. Resources include literature on general airport management responsibilities, such as asset management, environmental stewardship, and contract management, while others, such as proposed ARFF standards, have a more tangential connection.

Airport management includes a large volume of work and a range of resource types available, including four tools. Contextually, the majority of the published resources are related to the airport organization as a whole, but some resources are

classified as airside, terminal, and landside. These documents have been written mainly for both management and external audiences. Because of the nature of the topic, none of the resources are written for trainees.

Observations. The research literature cataloged under airport management seems to provide a thorough investigation of management issues; many issues receive full-length book focus, and resources include a mix of tools and guidebooks. Most management topics, however, are directed at small airports, and there may be a need to produce resources for airport management at large airports.

Based on initial observations, areas in which future research could be beneficial include:

- Managing airport systems (more than one airport);
- Minimizing risk for airport managers and airport board members;
- The impact of a consolidated, slower growing airline industry and changes in the distribution of traffic on airports ranging from large gateways to smaller regional airports;
- Examining what it means to be a public service airport;
- Alternative governance/board structures, including those that facilitate successful business practices;
- The changes in role and expectations for airport managers in the changing aviation industry;
- The challenge of forecasting in today's aviation industry (the days of assuming 3% growth are over);
- Lessons learned from Superstorm Sandy and other disruptive events;
- Competition among airports in overlapping catchment areas for air service and for economic development (related aeronautical industries);
- Triple bottom line management;
- Best practices in the global aviation industry and other sectors for models of airport-airline engagement;
- What strategies are available to retain current air service in an era in which many airports are losing air service;
- New models for incorporating performance criteria for airline service levels in airport use and lease agreements;
- Performance criteria and scorecards for tenants and public service providers, such as TSA and Customs and Border Protection (CBP); and
- Best practices of non-U.S. airports and what U.S. airports can learn.

Policy and Planning | Airport Financial Management

Airport financial management includes subjects related to the financial management of the airport that are usually the responsibility of the airport manager or the finance director. This sub-topic includes risk management as it relates to financial risk, but does not include risk management as associated with operational safety. The scorecard for airport financial management is presented as Figure 14.

Summary. This sub-topic covers concepts related to the financial management of an airport that are usually the responsibility of the airport manager or the finance director. These topics include risk management as it relates to financial risk but not risk management topics associated with operational safety.

Nearly 20 published ACRP resources and another 20 projects in progress are related to the financial management of an airport. Although this sub-topic is well

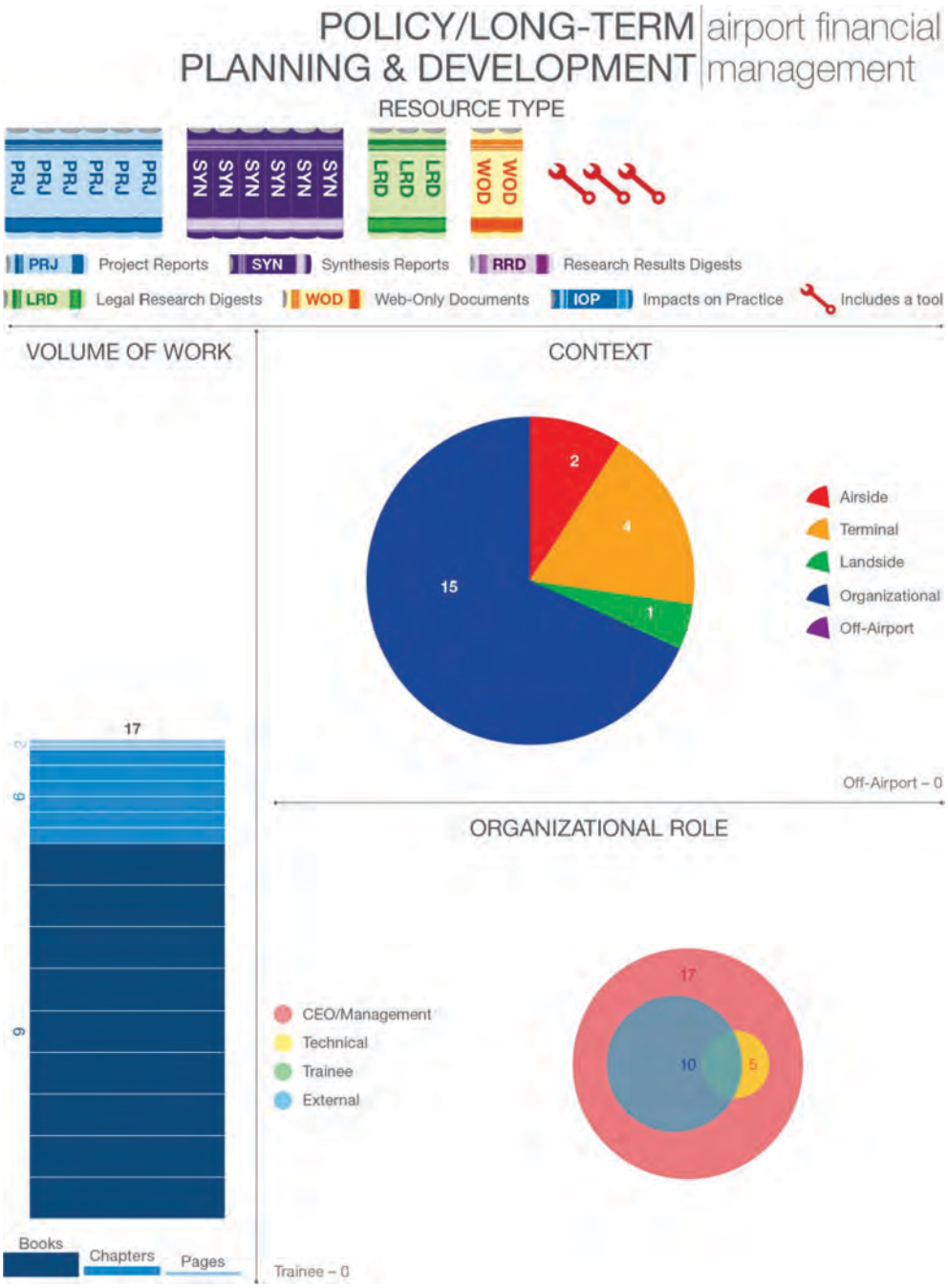


Figure 14 Scorecard—airport financial management.

covered in terms of the volume of information available, additional resource types could be beneficial—specifically the development of additional tools an airport manager or finance director can use to complete necessary financial management tasks. Not surprisingly, the audience for the majority of the available resources is airport management, and the resources relate to the airport organization as a whole.

Observations. The practice of financial management is universal, so it is likely that resources exist outside of ACRP that are related to the core concepts of financial management that should be inventoried as a part of a larger gap analysis. As

it relates specifically to airports, the majority of the published ACRP resources on financial management are directed at small airports; therefore, a need for financial management resources for large airports may exist.

Additional suggestions for future research include:

- Tools airport managers can use to help with the fiscal management of airports, specifically:
  - Understanding opportunities for airport revenue;
  - Developing an airport capital improvement plan (CIP);
  - Cost and revenue considerations of airport activities; and
  - Working toward self-sufficient airport operations.
- New models of funding airports given the slower growth/drop of aviation-related revenues, declines in passenger facility charge authority, and fiscal pressures on the airport improvement program;
- Federal mandates (regarding safety, security, or facilitation), combined with cost-shifting, which together place more financial burdens on airports;
- The business case for general aviation airports in the aftermath of FAA's asset study *(General Aviation Airports: A National Asset);*
- Best practices of innovative asset management;
- Federal mandates/cost-shifting to airports and the implications for airlines;
- Recordkeeping;
- Viability of air service incentives, fee waivers, and other possible models of adding air services;
- The business model of U.S. airports, involving:
  - Assumption of responsibility for traditional airline functions (e.g., ground handling) and government functions (e.g., paying for facility modifications and mandated security staffing);
  - Public, commercial (i.e., similar to Canadian model), and private ownership alternatives for U.S. airports;
  - Funding infrastructure for U.S. airports—lessons from abroad and other industries; and
  - Opportunities and threats to U.S. airports and the effects on our assumptions about the role of airports and funding models.

Policy and Planning | Economic Development and Revenue Generation

Economic development and revenue generation is related to developing land for revenue generation, which also includes third-party development and non-aeronautical land uses. The scorecard for economic development and revenue generation is presented as Figure 15.

Summary. This sub-topic covers literature related to developing land for revenue generation generally, and includes third-party development and non-aeronautical uses specifically. The practice of economic development and revenue generation is extremely important to airports for their continued operation and for making progress toward self-sufficiency.

When the economy is stretched and resources are limited, guidance on generating revenue and fostering economic development is crucial. Although the majority of airports in the United States receive funding assistance from the FAA and/or state and local government, additional funding is needed to match these contributions and to keep the airport functioning. One way to generate additional revenue is through the sale, lease, or development of airport property for business purposes.

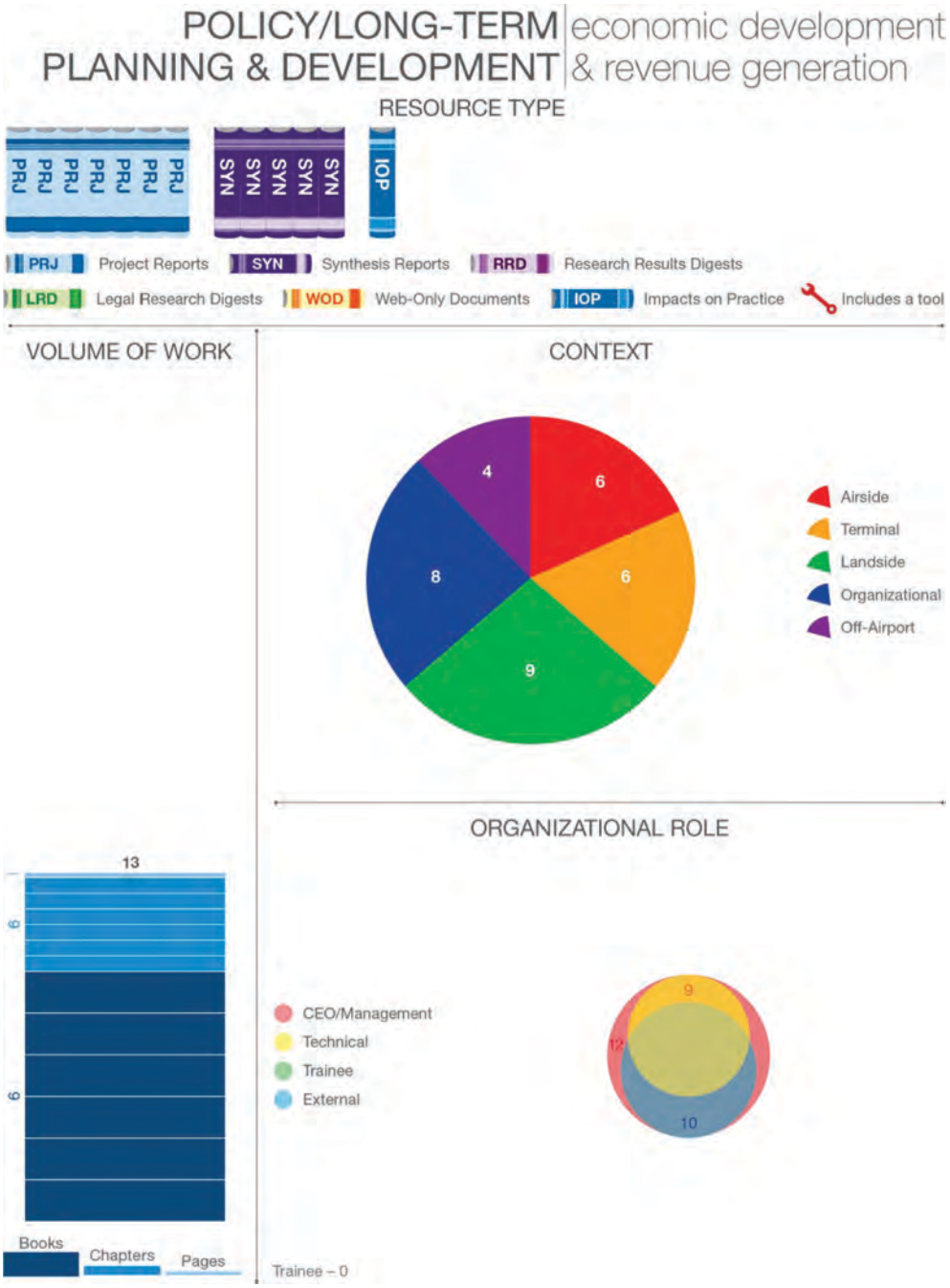


Figure 15 Scorecard—economic development and revenue generation.

The project team identified 13 published ACRP resources and another 13 projects in progress that are related to economic development and revenue generation. Third-party development and non-aeronautical uses have been discussed only briefly in ACRP resources published to date, with the exception of parking (which is considered a non-aeronautical use). A few reports have been written on parking strategies and needs. Third-party development is explored as a tool related to leasing property and airport concessions.

To date, published resources have focused on contractual elements and revenue stream, and have been written for a combination of management, technical, and

external audiences. Contextually, research has been evenly spread across airside, landside, terminal, and the airport organization as a whole.

Observations. Although resources outside of ACRP exist that relate to the general topic of economic development and revenue generation, employing those concepts at an airport can be challenging given specific challenges related to security issues and land release policies. Therefore, the provision of guidance and tools for airport-specific economic development and revenue generation is important. There may be an additional need to produce tools for use by airport managers to generate additional revenue and promote economic development at their airports.

Potential areas for further investigation include:

- Attracting non-aeronautical uses (marketing);
- Using third-party developers;
- Airport land use compatibility lessons learned with non-aeronautical uses;
- Impact and coordination of development with airport systems and resources (i.e., security, fire, SMS);
- Planning for multimodal transportation systems/connections at airports;
- Challenges and benefits of converting property from aeronautical to non-aeronautical use;
- The potential for private capital to play an enhanced role for airports, including privatization, public-private partnerships, and alternative project delivery; and
- Commercial business practices that offer potential for diversifying airports' revenue base and changing management practice.

Policy and Planning | Airport Planning

Airport planning includes subjects related to airport layout plans (ALPs), master plans, land use planning, capacity, FAA compliance, and design standards. The scorecard for airport planning is presented as Figure 16.

Summary. Airport planning includes the largest number of ACRP resources written to date, with nearly 30 published documents and more than 20 projects in process.

Given that airport-related planning is a critical element of most projects and processes, it is widely covered across ACRP publications. Guidance provided to date ranges from a page in length (e.g., in *ACRP Report 34: Handbook to Assess the Impacts of Constrained Parking at Airports)* to an entire project report (e.g., the two-volume *ACRP Report 27: Enhancing Airport Land Use Compatibility* and *ACRP Report 20: Strategic Planning in the Airport Industry).* In addition to the more traditional planning efforts (ALPs, master plans, etc.), design standards are included in this sub-topic and are covered in literature such as *ACRP Report 52: Wayfinding and Signing Guidelines for Airport Terminals and Landside.*

The majority of the published guidance has been written for the management audience, with several documents also written for the technical/professional audience. Some documents are aimed at an external audience (e.g., local municipalities, airlines), but only one of the resources has been written for trainees. Contextually, the resources are evenly spread across airside, terminal, landside, off-airport, and the airport organization as a whole.

Observations. A large volume of published literature is available regarding the sub-topic Airport Planning, but the industry could benefit from specific guidance on how

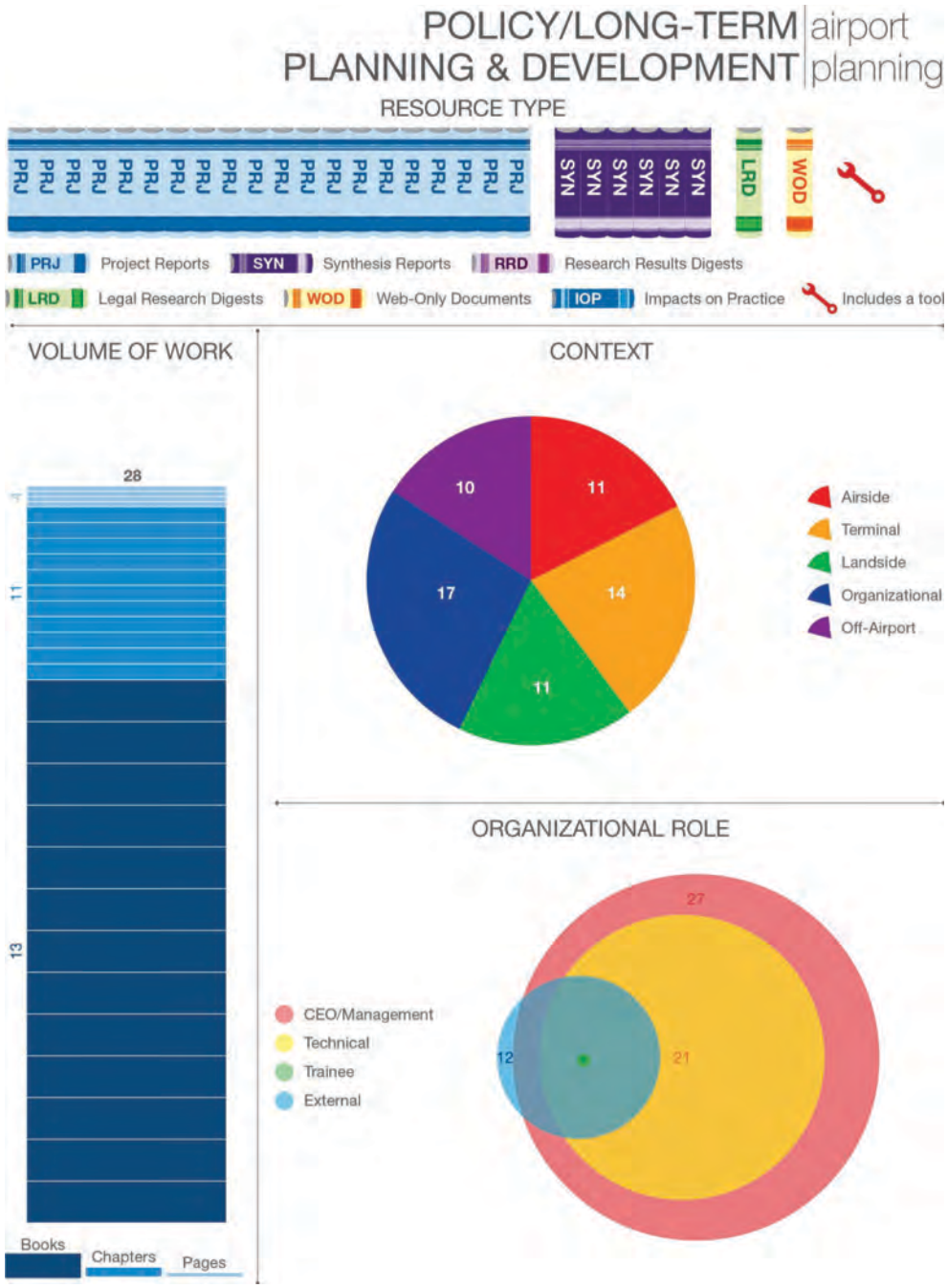


Figure 16 Scorecard—airport planning.

to connect airport planning to other planning and legislative efforts at the local and regional level. The disconnect between airport planning and traditional community planning efforts has been detrimental to many airports. Specific suggestions for future research include:

- Integrating an airport's master plan and ALP into local and regional planning efforts, such as land use planning, regional and local transportation plans, and capital improvement planning;
- The impact of local planning activity on airport operations;

- A best practice guide on developing ALPs and master plans to be used in conjunction with FAA's AC 150/5070.6B;
- A primer on the role of ALPs and master plans for an external audience;
- A survey of state legislative actions related to aviation planning;
- Best practices on meeting FAA compliance nuances (e.g., land use within runway protection zones [RPZs]);
- Understanding the meaning and latitude available under FAA grant assurances;
- Implementing surface movement guidance control systems (SMGCS);
- Understanding the variety of projects being tested around the nation that may impact airports;
- Planning, including the airport layout (or footprint) and terminal needs;
- Demand modeling and aligning airport and surface transportation planning; and
- The role of rail (including high speed rail) as a possible replacement for short-haul aviation, especially in congested metropolitan areas.

Also, although airport planning efforts often are the responsibility of an airport manager or consultant, it may also be helpful to have some guidance for new hires on planning issues.

Policy and Planning | Sustainability

This sub-topic covers sustainability initiatives across all parts of an airport. The scorecard for sustainability is presented as Figure 17.

Summary. Sustainability includes research initiatives across all parts of an airport. Sustainability and efforts to be "green" have been embraced around the world as—in conjunction with increasing fossil fuel prices—research continues to bring to light the impact of waste. During the last several years, sustainability efforts related to airports have been undertaken more frequently (e.g., recycling of old pavements and retrofitting existing facilities to meet current airport needs). Additionally, the installation of technology to utilize alternative energy sources (e.g., wind and sun) has been seen at airports across the country. The development of Leadership in Energy and Environmental Design (LEED)-certified airport terminals and other facilities (e.g., ARFF/SRE) also is on the rise.

Among existing ACRP publications, 15 were classified within the sustainability category, along with another seven research projects currently in progress. The majority of the published resources are book-length reports geared toward the management audience; however, there is also a large focus on both technical/professional and external audiences. None of the documents on sustainability have been written for trainees. Contextually, the guidance is evenly spread across airside, terminal, and landside areas, and little is written for the off-airport context.

Observations. Most of the resources published to date provide a broad view or a primer on the emerging topic of sustainability at airports. It is likely that additional research on sustainability will be needed as green technologies continue to develop and improve and as energy costs constitute a higher proportion of airport costs. Based on initial observations, areas in which additional research could be beneficial include:

- Implementing sustainable airport, aircraft, and airline operations to reduce the environmental footprint;
- Determining the economic benefit of sustainable airport practices; and
- Sustainable master plans (a relatively new FAA endeavor).

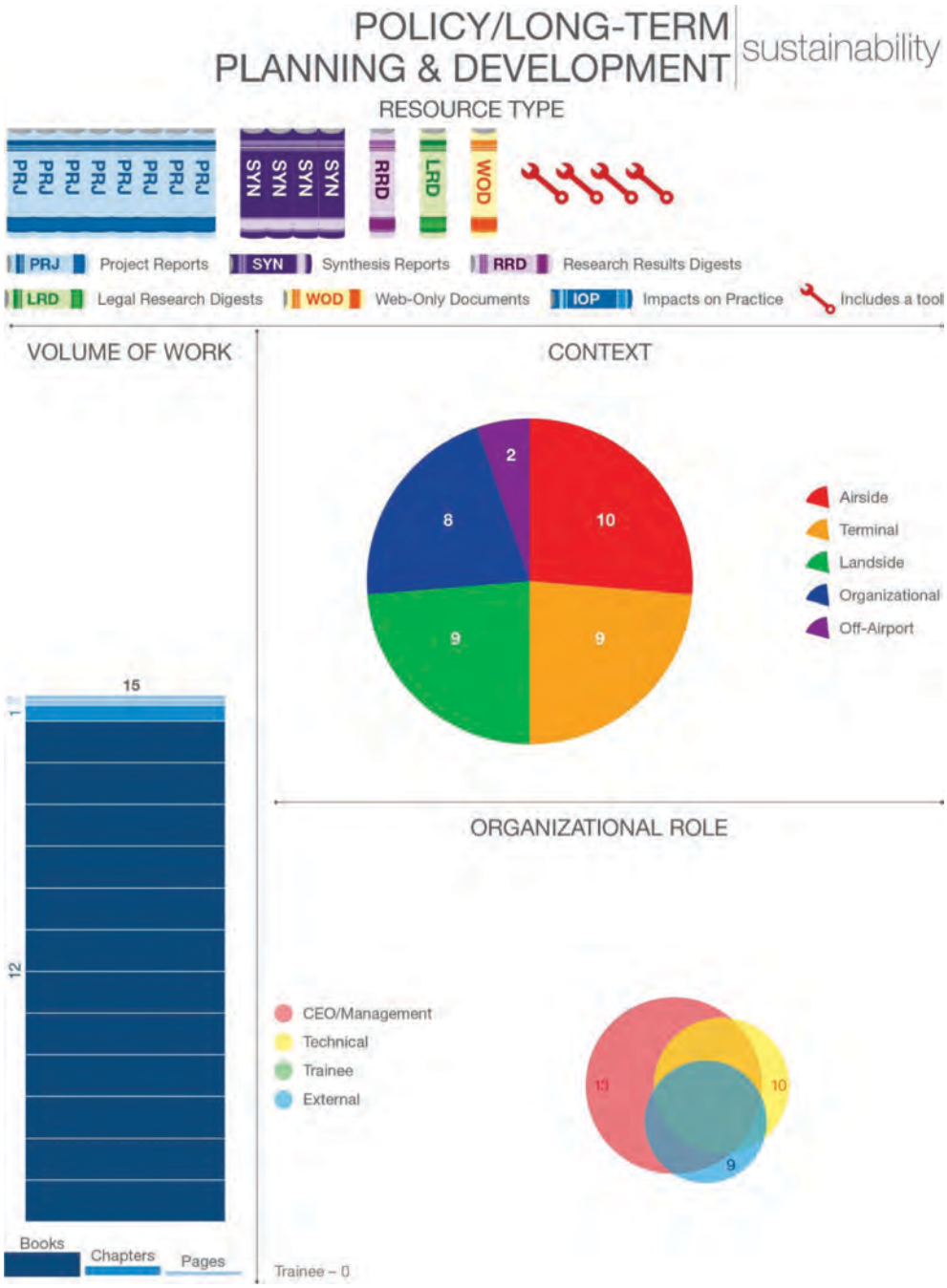


Figure 17 Scorecard—sustainability.

Policy and Planning | Public Relations

Public relations covers material related to all aspects of airport public relations and communications with the following entities: the traveling public, tenants, communities, elected/government officials, and other agencies. Public relations and communications also include the use of social media and intelligent transportation systems (ITS) for on- and off-airport audiences. The scorecard for public relations is presented as Figure 18.

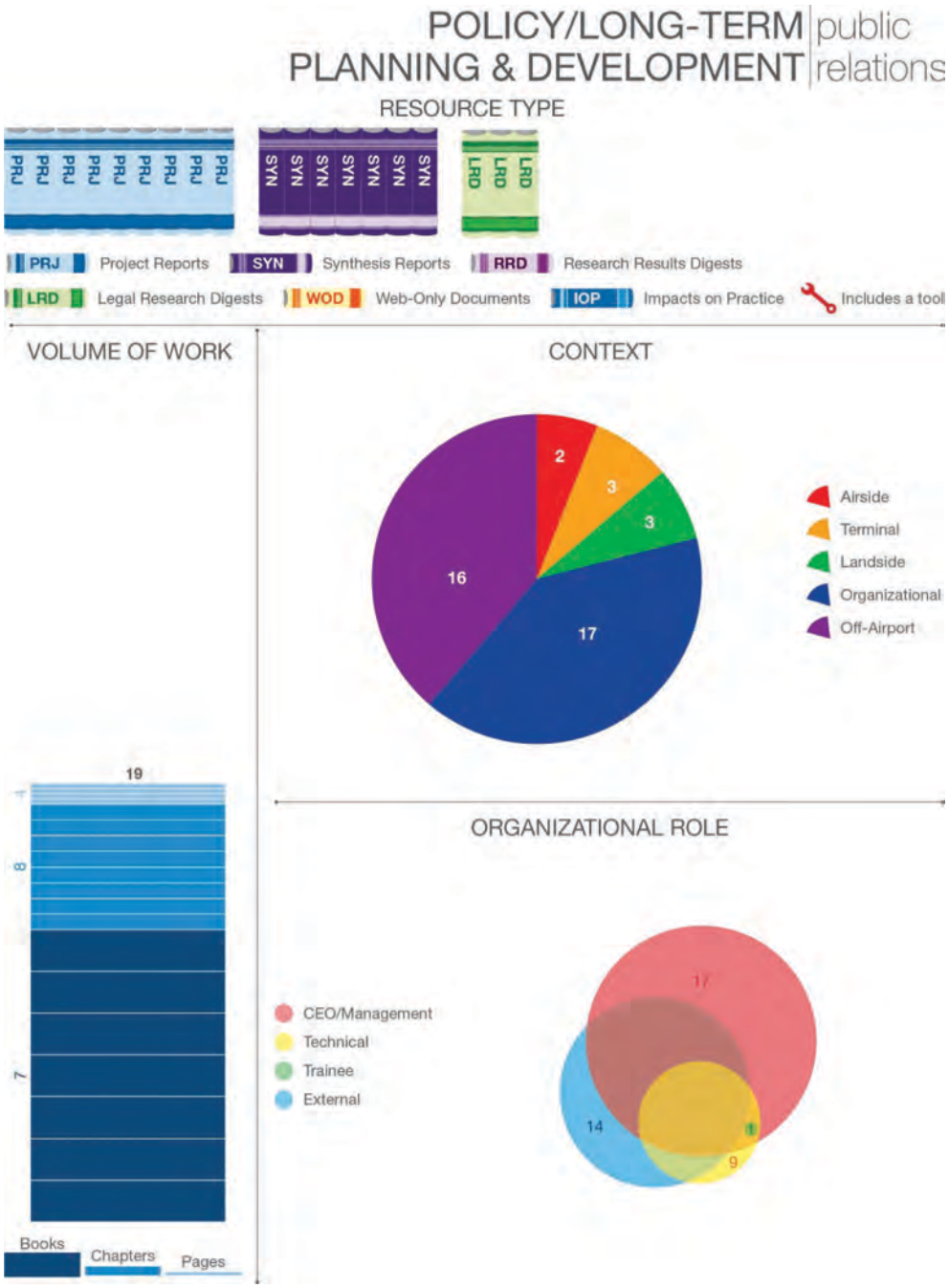


Figure 18 Scorecard—public relations.

Summary. For an airport to remain a viable part of its local community—and meet its service, financial, land use, and other goals—it is important that the airport be able to maintain positive relationships with a host community, airport tenants, government entities, and the general public. Too often, an airport is perceived as a separate entity and does not reach out to the surrounding community. With advances in technology and the growing popularity of social media, it is becoming easier for airports to stay in contact with their stakeholders. More than 25 ACRP resources (published and in progress) address stakeholder relations in some way, whether they

are aimed at helping an airport foster positive relations through traditional methods, such as attending local meetings and hosting airport events, or emerging methods, such as social media and other communication technologies.

The two main audiences for the resources published to date are management and external individuals or organizations. Similarly, the two major contexts are the airport organization as a whole and off-airport. A variety of resources address the public relations concept; however, no tools are provided.

Observations. Although this sub-topic is addressed briefly in several documents, no one resource specifically addresses airport relations with the community, elected officials, government agencies, and airport tenants. Ideas for future research that may offer valuable additions to the discussion include:

- A toolbox resource for improving community relations;
- Airport participation in community economic development conversations;
- An "Airports 101" resource written for local, state, and federal officials and agencies that presents the big-picture perspective of airports and a general overview of airport operations;
- Establishing and maintaining positive relationships with airport tenants, FAA, and others;
- Planning for tenant facility needs (including space, technology, and operational needs);
- Establishing a process to keep city/county/state officials updated on airport activities and projects; and
- Using social media to improve airport relationships with stakeholders.

The AOC workshop resulted in the following additional recommendations for future research:

- Communicating with local stakeholders about the realistic commercial viability of airports, their air service potential, and roles within the aviation system;
- Serving the customer amid enhanced service expectations of airports, changes in technology, and a customer-centric culture;
- Addressing language- and culture-related challenges/unique customer needs;
- Integrating information technology (IT) planning from the IT backbone that supports the administrative and operational functions of the organization to business models for providing services to meet customer needs;
- Understanding airlines' goals;
- Understanding what passengers want from airports and airlines;
- Understanding what general aviation users need;
- Communicating and cooperating among parties to meet goals;
- Models of communicating to the community about environmental impacts;
- Engaging the community in understanding airports' roles in the Next Generation Air Transportation System (NextGen), such as impacts on emissions and noise contours;
- Communicating benefits (e.g., environmental benefits) of NextGen to the community;
- Collaboration with the Radio Technical Commission for Aeronautics (RTCA) on NextGen and SMS; and
- Best practices in surveying the entire door-to-door experiences of airport customers.

Policy and Planning | *Safety Management Systems*

This sub-topic covers the evolving subject of SMS, which affects all areas of an airport. The scorecard for SMS is presented as Figure 19.

Summary. SMS is an evolving issue across all areas of an airport; however, given the relatively short history of SMS for airports, it is unsurprising that the published resources are limited in number. More than 10 resources were cataloged under this sub-topic during the inventory: seven publications and four projects currently in progress. Of all of the sub-topics listed under ACRP Research Field 3, SMS has

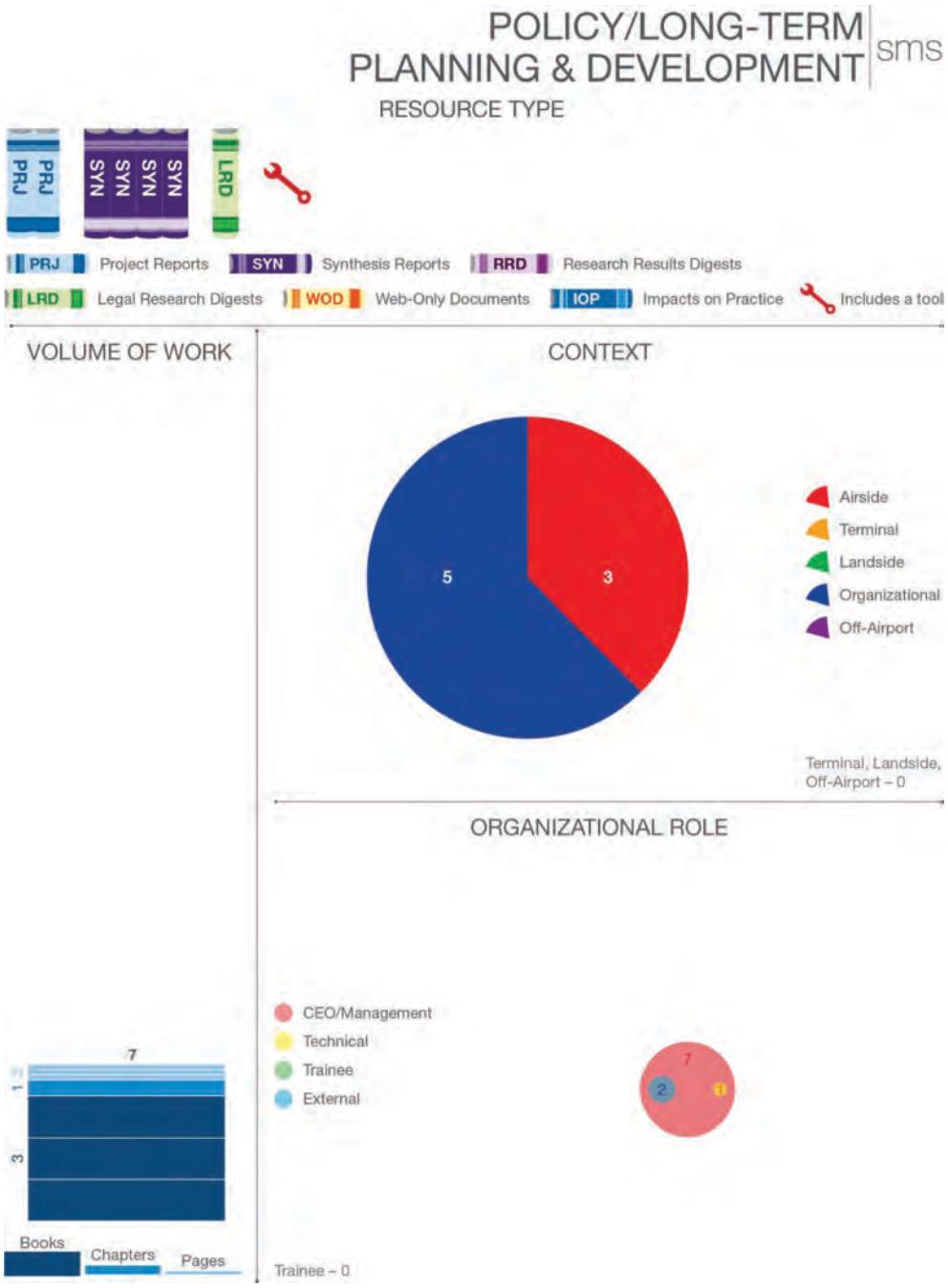


Figure 19 Scorecard—SMS.

the greatest number of resources aimed at trainees; however, management is still the audience for the majority of resources. Contextually, this concept is focused on the airport organization as a whole, followed by airside areas. This is not surprising as SMS activities and processes are often defined and established by airport staff at the administrative level, and then carried out by operations staff.

Observations. A few resources on SMS have been published, such as ACRP *Report 1: Safety Management Systems for Airports.* However, as indicated by FAA's Notice of Proposed Rulemaking for SMS at certified airports (Docket No. FAA-2010-0997; Notice No. 10-14), FAA regulations on SMS are likely changing, and guidance that aligns with these changes will be needed. Additional ideas for potential future research include:

- SMS best practices, and
- Safety practices for specific airport activities with high accident potential, complementing or updating existing ACRP studies on ramp safety, apron safety, and foreign object debris (FOD) inspection practices.

ACRP Research Field 6—Human Resources

The discipline of human resources (HR) involves the recruitment, management, and development of an organization's workforce. HR also includes leadership training and the development of a specific culture or work environment. Employees carry out the operational tasks of the organization and are an asset, and also are a collection of unique social beings. Positive indicators of HR endeavors include high employee satisfaction and retention, increasing productivity, and efficiency, improving safety, expanding skill sets, and seamless leadership transitions.

At an airport, management is carried out through some combination of roles shared by an airport manager and an airport board or commission. Depending on the overall size of the airport staff, HR responsibilities may rest with the airport manager or may be carried out by a dedicated individual or team.

In ACRP Research Field 6, the ACRP research literature has been cataloged into the following six sub-topics:

- Recruitment and staffing,
- Training and workforce development,
- Leadership development and succession planning,
- Work environment,
- Emergency response training and support, and
- Organizational structures.

HR applies to every organization with employees. Universities around the country offer advanced degrees in HR and labor relations. Federal and state agencies focus on employment as related to the national economy, wage issues, workplace safety, equality, and other areas. Industry organizations research and advocate for employers and employees. For each sub-topic listed under ACRP Research Field 6, elements of the research literature are unique to the aviation world, as suggested by such titles as *ACRP Synthesis 18: Aviation Workforce Development Practices* and *ACRP Report 75: Airport Leadership Development Program.*

Human Resources | Recruitment and Staffing

Recruitment and staffing includes HR resources before and through the hiring process, including documents that address organizational branding, recruiting out-

reach, and hiring practices. Also included are resources related to wages and benefits in the aviation industry, including industry trends and comparison with other industries. The scorecard for recruitment and staffing is presented as Figure 20.

Summary. Recruitment and staffing addresses knowledge and practices related to the hiring of employees, including branding, recruiting outreach, and steps in hiring practices. This sub-topic also covers wages and benefits in the aviation industry.

ACRP's recruitment and staffing literature includes one project report and two synthesis reports. No tools are provided. *ACRP Synthesis 18: Aviation Workforce*

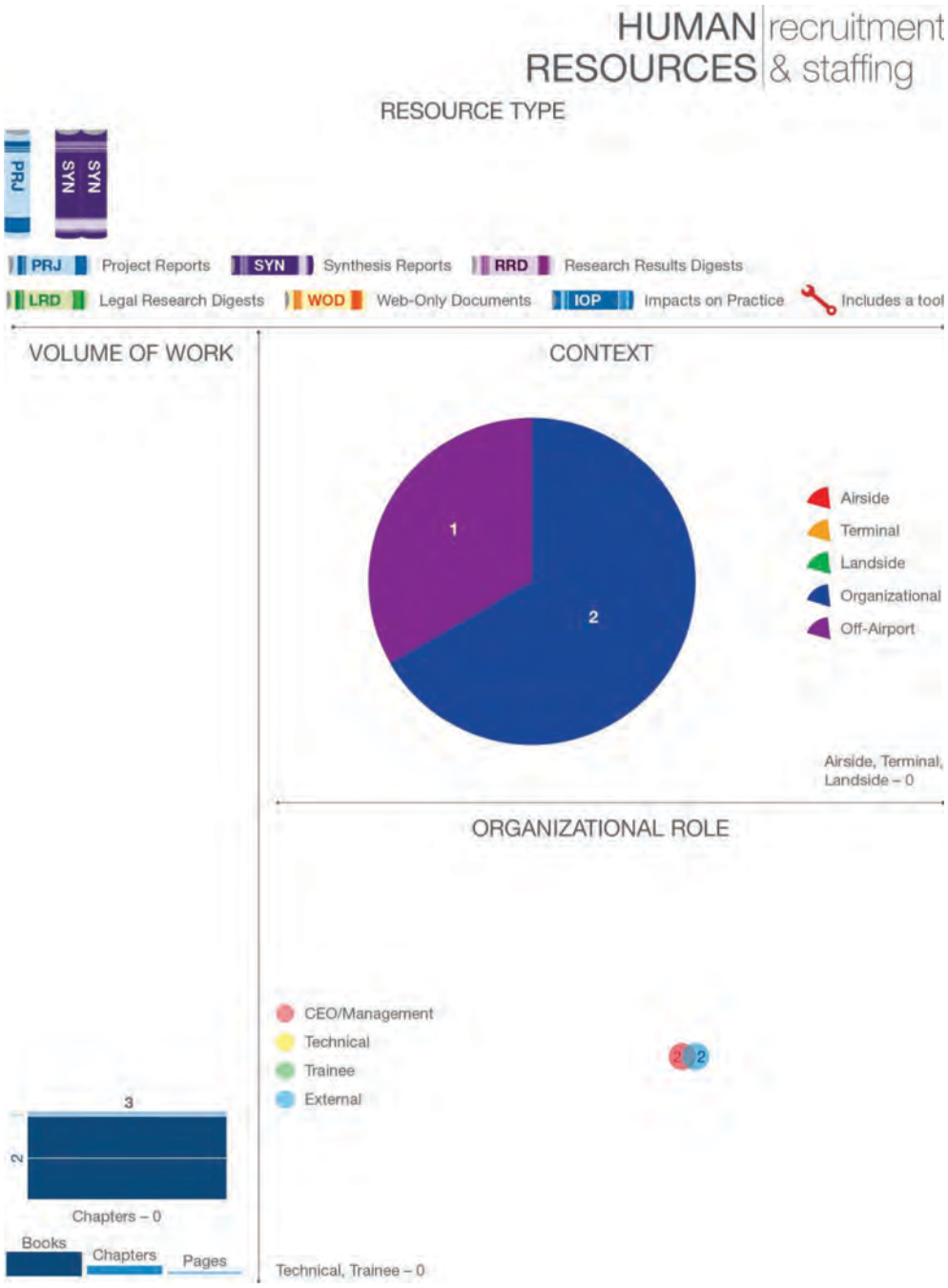


Figure 20 Scorecard—recruitment and staffing.

Development Practices contains the most specific treatment of recruitment and staffing subjects. Most of the resources focus completely on this topic area and are written for airport management and external audiences, including airlines. In a similar manner, the context is classified as organizational and off-airport. This is not surprising given the administrative nature of the topic.

Observations. Recruiting and staffing for the aviation industry makes up a unique segment within the labor and employment industry. The inventory suggests that ACRP research continue to focus on recruitment and staffing connected to the aviation industry. One area of potential need is to discover or produce aviation industry-based tools that airport managers can use for branding, recruiting, and hiring.

Trends and legislation in the larger labor and employment industry also may provide advance notice of topics that could impact the aviation industry. For example, current national demographic trends indicate that there will be a national shortage of labor spanning several decades as baby-boomers retire and the working-age population drops. Consequently, the need to recruit qualified employees to the aviation industry may grow, and the pay scale to recruit qualified candidates may rise—topics that cross over to economic and financial areas of interest. Areas of interest for future research include:

- Attracting new leaders and staff to tomorrow's industry,
- Understanding today's airlines and how they perceive and staff for airports, and
- Reviewing literature published by universities and other educational institutions where future aviation leaders are being trained as well as airlines and their professional organizations for information on airport staffing.

Human Resources | Training and Workforce Development

Training and workforce development includes HR resources related to training of employees, especially safety training, technical skills training, and training in the use of IT resources. This sub-topic does not include emergency response training, which is addressed in the ARFF/Emergency sub-topic under ACRP Research Field 10—Operations (Airside). The scorecard for training and workforce development is presented as Figure 21.

Summary. Resources covering knowledge and practices related to employee training, especially as it relates to safety, technical skills, and the use of IT resources, are cataloged within this sub-topic. Although the training topic addresses the work environment for people already employed at an airport, workforce development includes sector-based strategies that focus on matching workers' skills to industry needs.

Resources on training and workforce development represent the largest volume of work within the HR topic. Six project reports, including one tool and six synthesis documents, have been cataloged under this sub-topic; however, the majority of these works address training as a chapter or in a few pages. For example, *ACRP Synthesis 29: Ramp Safety Practices* focuses on the larger topic of ramp safety and includes a chapter on training. Only three works are wholly devoted to training and workforce development. The context for these works crosses all areas of an airport—airside, terminal, landside, and organizational—which reflects the need to provide training across all areas of airport operations. The audience for these resources always includes management, usually includes technical/professional staff, and in some cases includes trainees or external audiences.

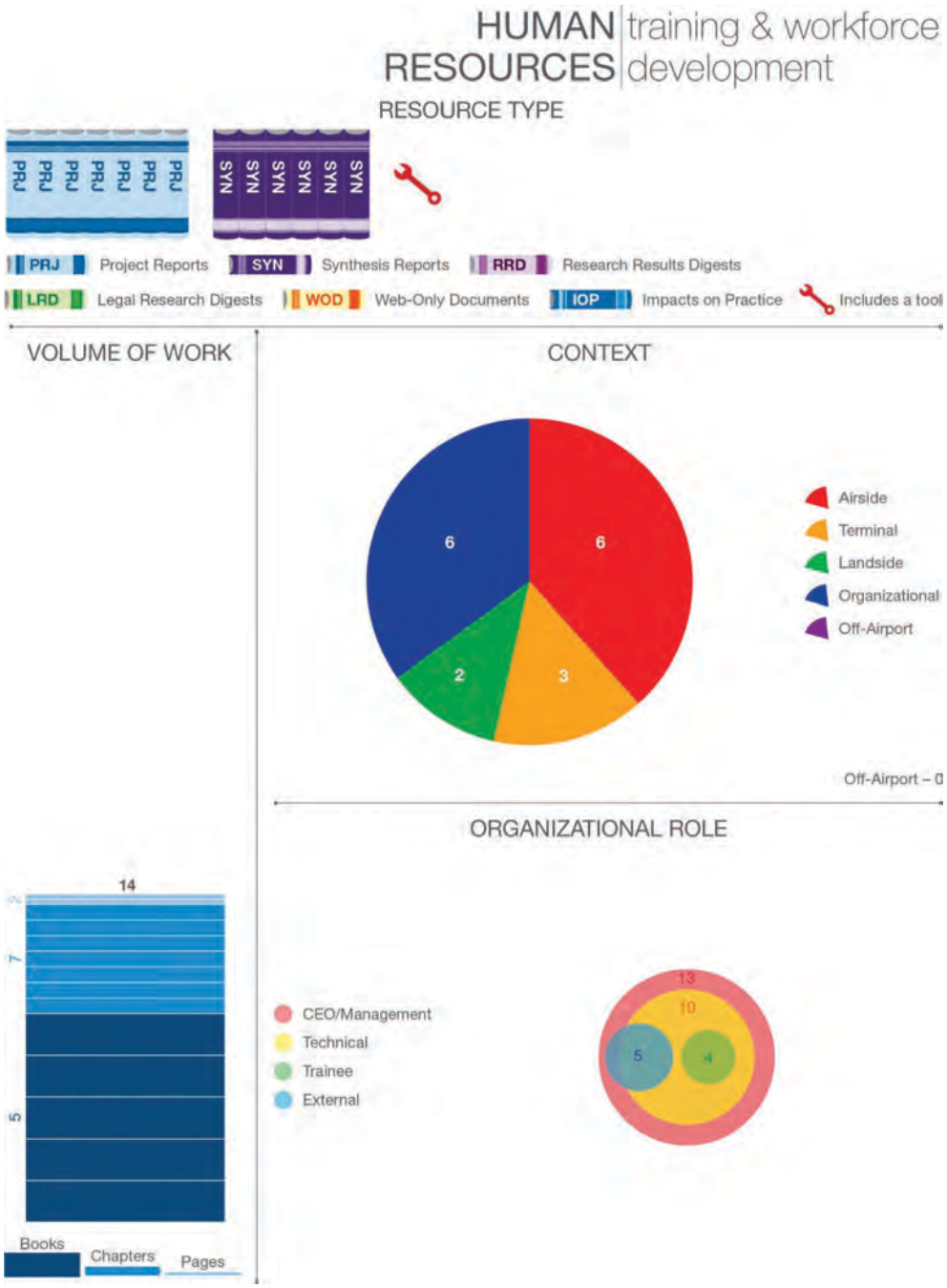


Figure 21 Scorecard—training and workforce development.

Observations. Training is included as a portion of the research topics associated with airport operations and will likely continue to be addressed this way. However, the topic of how to provide effective training at an airport generally does not appear to have been researched by ACRP. This may represent a gap in the current literature. As part of a future research project, the development of tools may be helpful for training exercises, recordkeeping, and guides.

A trend across all industries is the constant change and development of new IT resources. Changes and advances in IT are likely to drive changes in the aviation

industry, which will in turn create new demand for research and training. This is an area that could be reviewed annually for problem statements across all context areas—airside, terminal, landside, and organizational.

Separate from training of current airport employees, workforce development focuses on training the available labor pool to fill labor gaps in the aviation industry. Current workforce development programs often are provided by community colleges. It does not appear that ACRP research efforts have addressed this topic as it relates to the aviation industry. If the demographic population trend is a valid indicator of future shortages in the labor force, this topic may be timely. Accordingly, areas of interest for future research are likely to include new models of training for airport staff.

Human Resources | Leadership Development and Succession Planning

Leadership development and succession planning covers leadership development within an organization and includes career development training, effective management tools and techniques, and succession planning. This sub-topic also includes education and training for members of an airport board. The scorecard for leadership development and succession planning is presented as Figure 22.

Summary. Literature addressing leadership development within an organization, including career development training, effective management tools and techniques, and succession planning is included in this sub-topic. Education and training information for members of the airport board also is included here.

With regard to context, all of the documents in this sub-topic are classified as organizational. The audience for each resource includes management 100% of the time, as well as external entities in some cases, which is consistent with the administrative focus of leadership at an airport. Five project documents and three tools were identified in this sub-topic. Some resources were complete books, and other resources addressed leadership development and succession planning as chapters.

Observations. Airport management and leadership skills are taught and certified through the Accredited Airport Executive (A.A.E.) designation offered by the American Association of Airport Executives (AAAE). This industry organization has produced volumes of training material for airport executives, a factor that should be considered during the process of selecting of problem statements. Potential problem statements for future research include:

- Generational changes and the urgent need for succession planning, and
- The skills and training necessary for the next generation of airport leaders.

The urgent need for succession planning recognizes that many leaders in the aviation industry are approaching retirement age. Although no ACRP research projects were identified to address succession planning at airports, information may be available from other sources that are directly applicable to an airport organization. This information should be explored further to avoid duplication of research efforts.

Generational changes and the associated need to adjust work environments have been explored in popular literature with topics like how to manage members of the millennial generation and how to motivate generation Y in the workplace. A resource with a specific focus on the impacts of generational differences on future leadership in the airport environment may be needed.

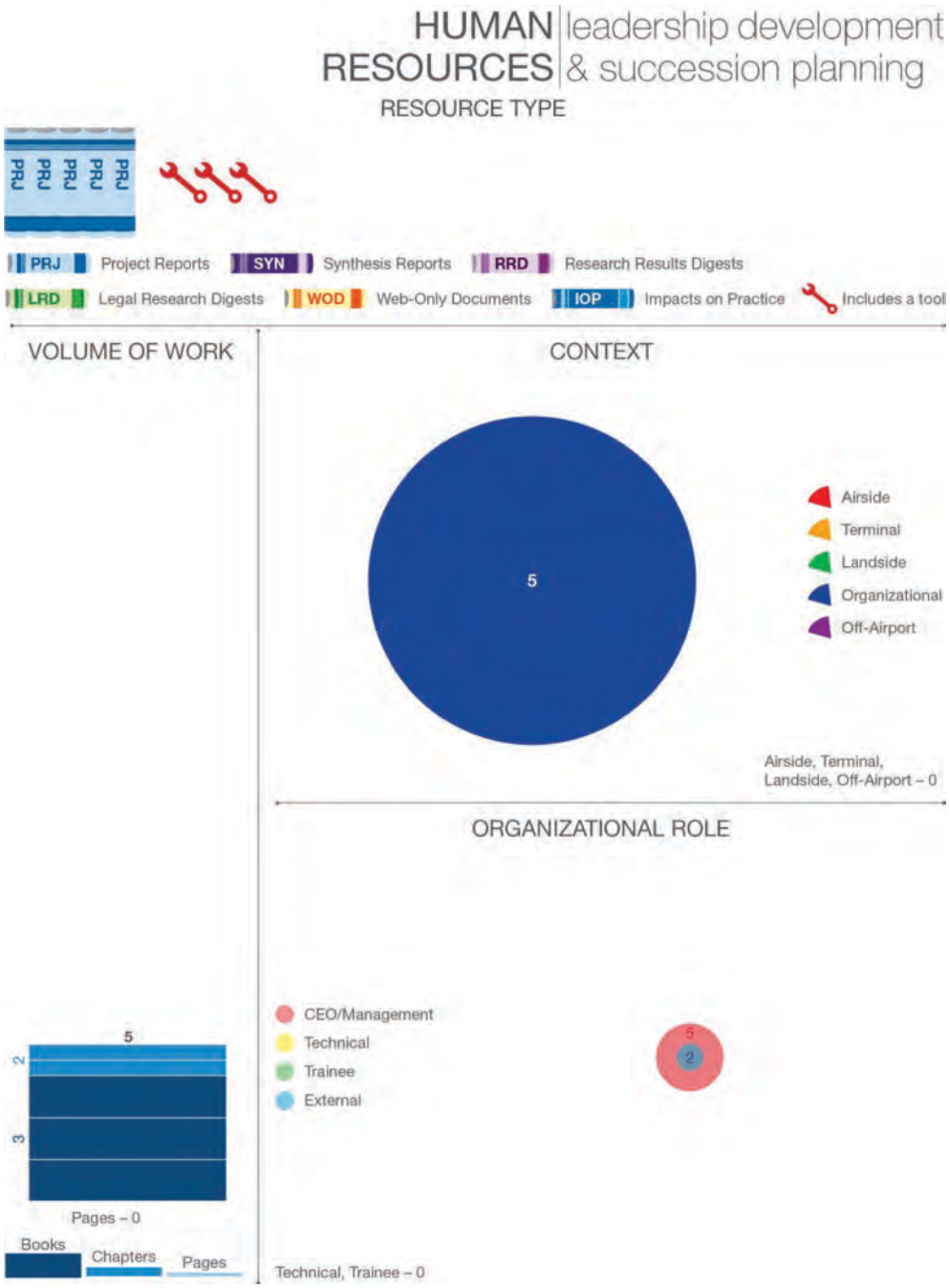


Figure 22 Scorecard—leadership development and succession planning.

Human Resources | Work Environment

This sub-topic addresses HR as it relates to creating a positive work environment/culture to boost productivity, employee satisfaction, and employee retention. The scorecard for work environment is presented as Figure 23.

Summary. In some ways, this sub-topic is similar to branding in the employee recruitment process; however, in this category the focus is on the active workplace and on current employees.

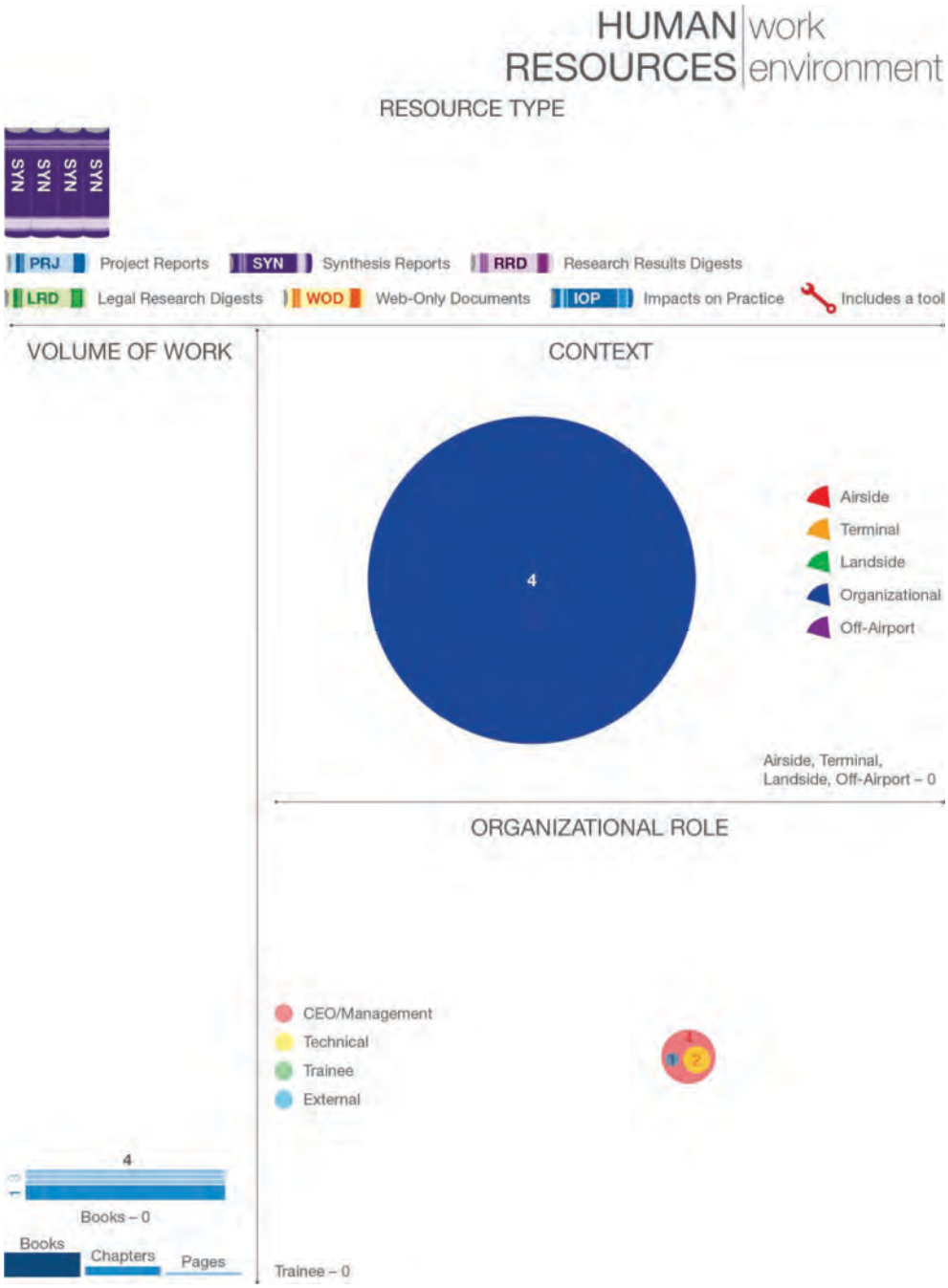


Figure 23 Scorecard—work environment.

This sub-topic appears in four different ACRP synthesis publications but is addressed only briefly in each as an element of an airport practice or facility plan. In each case, the primary audience is management and the context is organizational. Technical/professional and external audiences are addressed as a second audience in some publications. Given that this topic is not the specific focus of any of the resources, no tools have been developed.

Observations. Although work culture appears in several synthesis documents, this sub-topic has not been the central focus of an ACRP research effort to date. It has,

no doubt, been addressed by other sources of labor and employment research. It is suggested that further consideration be given to the question of whether the existing literature transfers directly to the airport work environment or whether the topic is ripe for additional, airport-specific research.

The work environment has a direct connection to the financial management of an airport. Higher employee retention reduces the costs associated with hiring and training (or re-training) employees. Higher productivity also lowers operational costs and/or provides more services without increasing labor costs. The economic cost of employee turnover—or the economic benefit of employee retention—in the aviation industry may be a gap in the current body of knowledge; however, these areas may have been explored through other aviation industry organizations.

This sub-topic also has a direct connection to implementing safety practices and other operational best practices. Safety issues in the airport workplace are largely unique to that working environment. Future research topics that address the implementation of safety practices might strengthen ACRP coverage of the work environment by including some research on shifting an airport's culture.

Human Resources | Emergency Response Training and Support

Emergency response training and support relates to emergency response preparedness as well as employee support and counseling for post-emergency events. It is separated from other HR training programs because emergency response training and support involves coordination with off-airport agencies, whereas training and workforce development focus on training and development for on-airport activities. The scorecard for emergency response training and support is presented as Figure 24.

Summary. HR-related emergency response preparedness and employee support and counseling for post-emergency events are combined in this sub-topic.

ACRP Report 22: Helping Airport and Air Carrier Employees Cope with Traumatic Events has a specific and complete focus on the support of employees after a traumatic event. This report was followed by an IOP document that looked at how one airport used the information. Two other resources include brief references to emergency response training and support, and a project report currently in progress focuses on the National Incident Management System (NIMS). The audience for these resources includes airport management and, in some cases, technical or external audiences. The context is usually an airport organization, but for one resource the context is airside.

Observations. Although this sub-topic focuses on emergency response, it is specifically defined by its connection to outside agencies and resources. Given this connection, literature may be available from sources associated with partner organizations. Similarly, drivers of change may come from other industries and agencies, which should be considered in future research efforts.

Since the September 11, 2001 (9/11), terrorist attacks, the aviation industry has been keenly aware of the possibility of terrorist threats, and many airports have developed plans to prevent and respond to these threats. The focus of emergency response at airports may need to include training for response to acts of terrorism. This focus may also become a driver of changes in airport design for airside, terminal, and landside facilities as well as operational and staffing practices. As ACRP considers research problem statements associated with emergency response

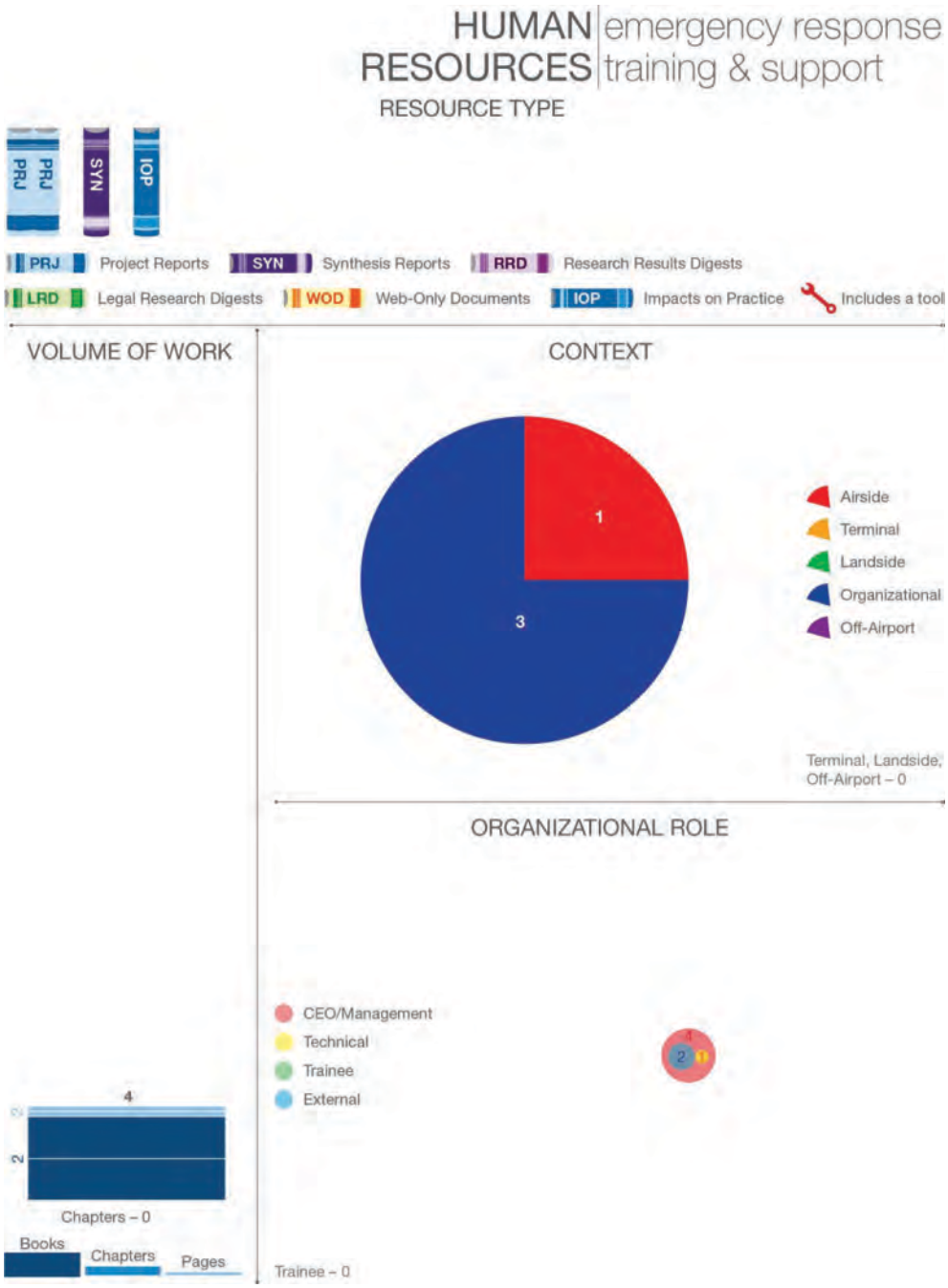


Figure 24 Scorecard—emergency response training and support.

preparation in this category, given the unique operating environment of airports, coordination with off-airport agencies that provide emergency assistance is suggested. In an emergency, airport personnel may be called upon to interact with law enforcement, fire fighting, medical, and military resources as well as the Red Cross or community social service agencies, communications networks, and local utilities. Because existing literature and tools may already have been developed, a synthesis report may be an effective resource with which to begin. The training topic may call for the development of tools as part of future research efforts.

Human Resources | *Organizational Structures*

The sub-topic Organizational Structures relates to the management structure within an airport, to the airport board, and to associated opportunities (i.e., funding, legislative, or legal resources), as well as privatization. The scorecard for organizational structures is presented as Figure 25.

Summary. Organizational structures capture HR subjects related to the management structure within an airport, to the airport board, and to associated entities. This

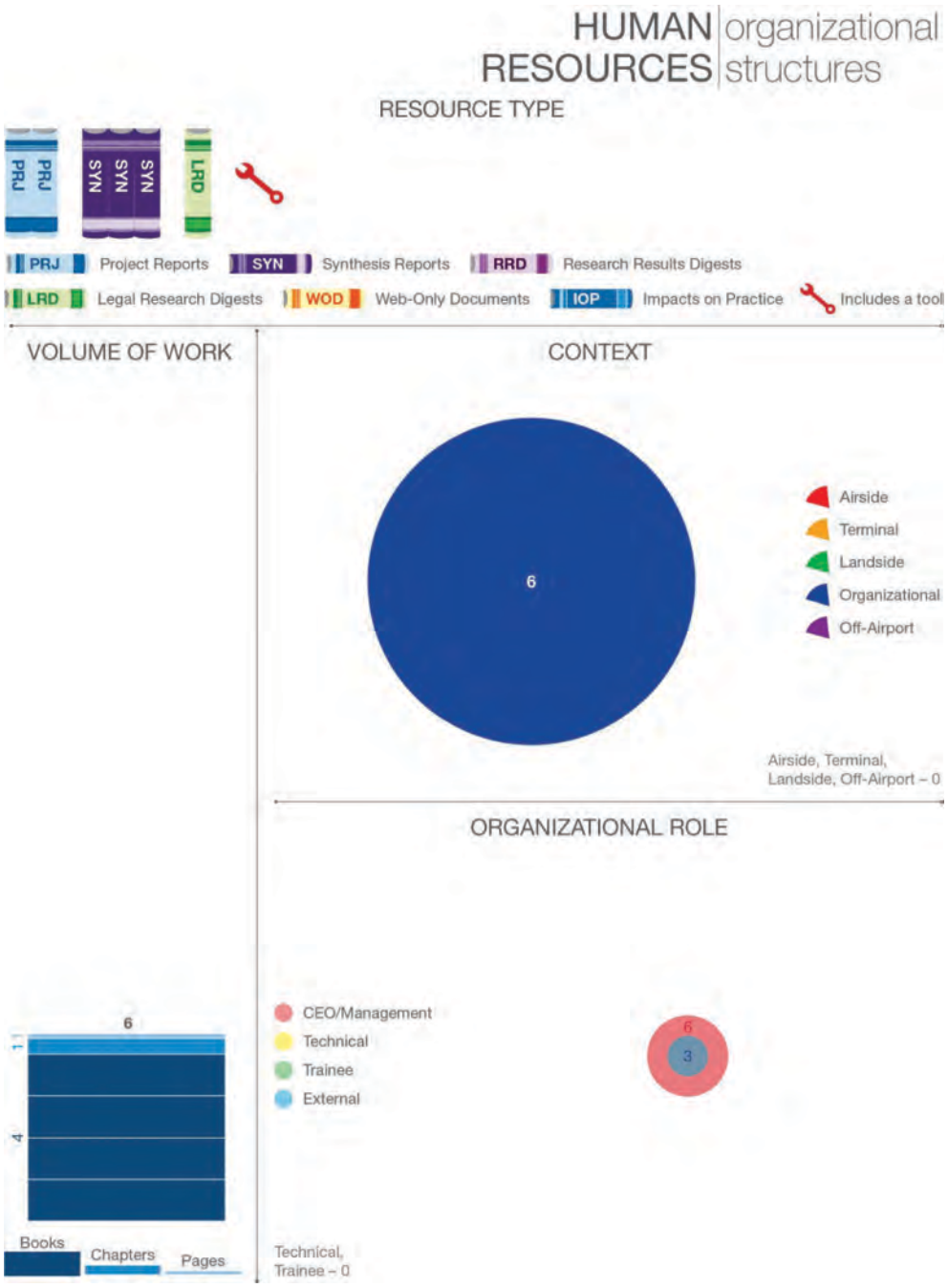


Figure 25 Scorecard—organizational structures.

sub-topic also covers the associated opportunities for funding, legislative functions, legal resources, and the subject of privatization.

This sub-topic is important in part because organizational structures have a direct impact on the bottom-line goals of an organization as well as on financial performance, including access to local tax revenues and staffing options.

Two ACRP project reports, three synthesis projects, and an LRD are classified here. Of these resources, three documents focus completely on organizational structures (e.g., *ACRP Synthesis 40: Issues with Airport Organization and Reorganization*). None of the research projects include a tool. The context is 100% organizational, which is appropriate. Likewise, the audience is 100% management. Three of the documents also address an external audience, which is an airport board or commission.

Observations. ACRP is well positioned to lead the national conversation about airport organizational structures, either independently or cooperatively with aviation industry organizations or universities. The sub-topic is connected to airport management and leadership as well as to economic development and revenue generation. Moving forward, the problem statement selection process should avoid duplication of work across these ACRP categories.

Although synthesis reports on revenue diversification and airport organization have been published, a project report in these areas may be warranted.

Future problem statements may be generated as a result of trends outside of aviation. For example, new technology and a shift toward self-service and automated functions at an airport may drive change in an airport's organizational structure. Also, recent debates about the U.S. DOT's Essential Air Service (EAS) program and its role in the national aviation system may impact research needs in this area.

The federal aviation system creates a national framework for airport operations in the United States that is fairly standardized. Because many other aspects of the airport are not as consistently similar, it may be helpful to look internationally for alternatives to current practices for other activities at the airport.

Another area with potential for future research is the implications of airline consortia for airports.

ACRP Research Field 10—Operations (Airside)

ACRP's Research Field 10—Operations has been split into two sub-fields; one covers landside operations, and the other covers airside operations. This first-phase inventory effort focused on airside operations. As with policy and planning, the field of airside operations has a very large scope. Numerous sub-topics are covered, including:

- Public safety,
- Fueling,
- Fixed base operators (FBOs),
- Irregular operations (IROPS),
- ARFF/emergency (a separate category from HR-related emergency training and preparedness),
- Non-movement area operations,
- Airfield inspection and maintenance, and
- Wildlife hazards.

Within these sub-topics, additional subjects are covered, such as FAA's Notices to Airmen (NOTAMs), weather, airspace and obstructions, safety areas, signs, mark-

ing, and lighting. It is important to note that research cataloged under some of these sub-topics also may also be listed under fields or sub-topics, such as ACRP Research Field 3—Policy and Planning. Although there is some overlap, the concepts tagged under ACRP Research Field 10 are truly operational in nature.

The resources inventoried under this topic will be most beneficial to those individuals responsible for the day-to-day operations of the airport beyond the security checkpoint.

Operations—Airside | Public Safety

Within airside operations, the sub-topic of public safety relates to airport security and includes NOTAMs, risk management subjects associated with operations, and weather-related subjects that impact safety and security. Public safety also includes airspace obstructions as they relate to operational safety. The scorecard for public safety is presented as Figure 26.

Summary. Issues related to airport security and related safety items are cataloged under this sub-topic. This includes NOTAMs, risk management associated with operations, and weather, which may impact public safety. Also included are airspace obstructions as they relate to operational safety.

This information contributes to maintaining the safety of persons on the ground and in the air, which is a top priority of the FAA. Because rules and regulations related to safety continue to evolve and new safety technology is being developed, guidance should be continually updated to reflect changes that affect airports and the aviation industry.

Ten ACRP resources are cataloged under this sub-topic. The majority of them are applicable to airside areas, followed by landside, and then the airport organization as a whole. Although various resource types are available on the subject, no tools have been developed for use by management or operations staff. The intended audience for this research is management, with limited application to technical/professional staff, external organizations, and trainees.

Observations. A wealth of research information from ACRP project teams has been produced regarding safety and security issues, but the majority of the guidance available is intended for use at smaller, general aviation airports. This may indicate a need for research guidance and/or safety and security best practices for use at larger hub airports. Additional suggestions for future research include:

- How to write a NOTAM—a standardization document that includes atypical situations;
- Methods for installation and justification for automated weather observing systems (AWOS) and automated surface observing systems (ASOS) at small airports;
- Maintenance of AWOS and ASOS at airports;
- Wind/downdraft early warning equipment;
- Weather/field condition reporting during snow/ice events;
- One engine inoperative departure surfaces; and
- Research complementary to *ACRP Synthesis 28: Investigating Safety Impacts of Energy Technologies on Airports and Aviation* regarding the impacts of energy technology on airport obstruction surveys.

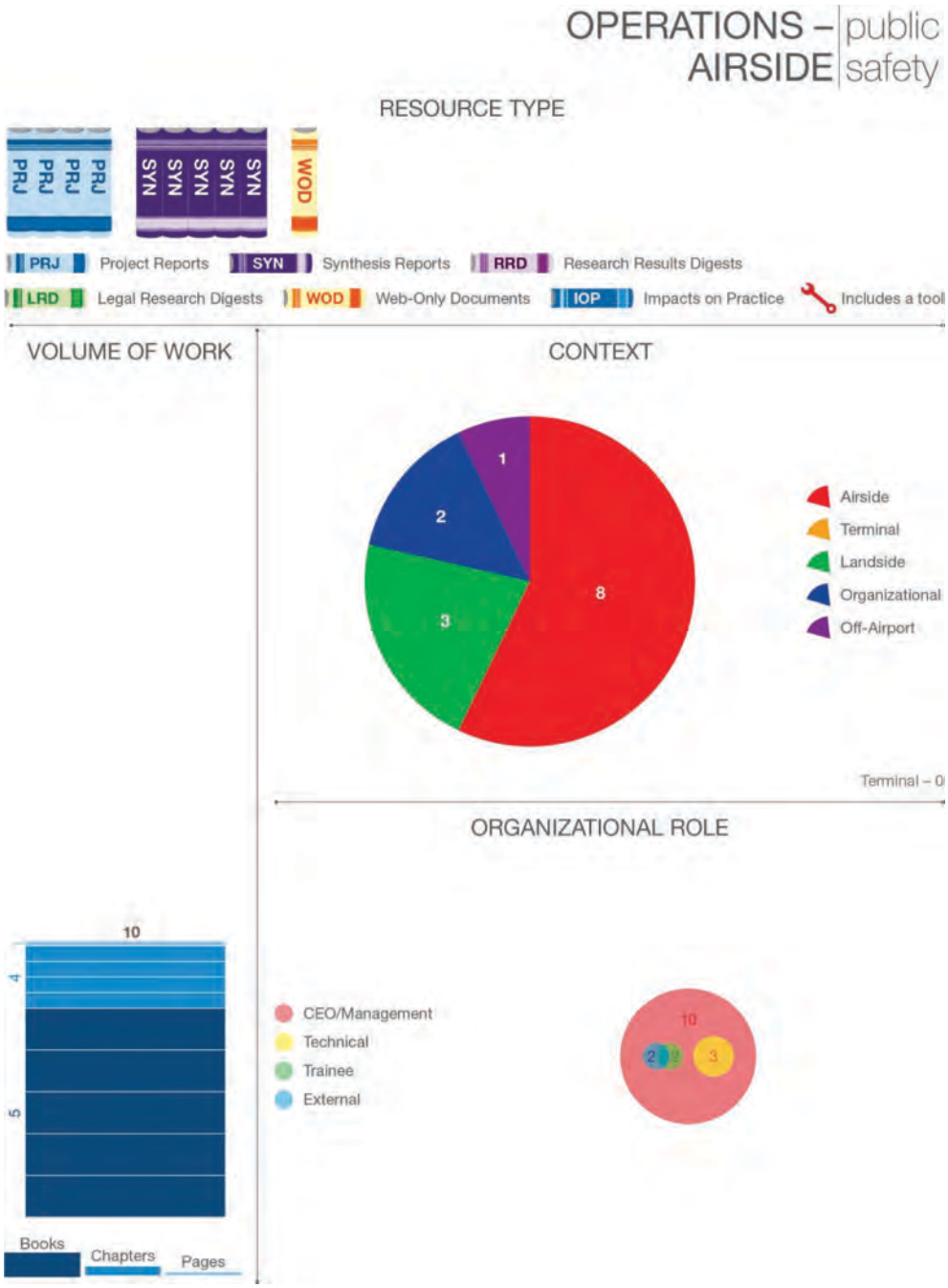


Figure 26 Scorecard—public safety.

Operations—Airside | Fueling

This sub-topic covers fueling subjects of concern or interest to operations staff. The scorecard for fueling is presented as Figure 27.

Summary. Within this sub-topic, knowledge and practice related to fueling is limited to areas of concern or interest to operations staff. It does not include fuel pricing and its related impacts. Fueling includes the physical movement of fuel, such as the transportation of fuel to the airfield, filling of fuel tanks on the airfield, dispensing of fuel into fuel tanks on all types of aircraft, as well as guidance on fuel emissions.

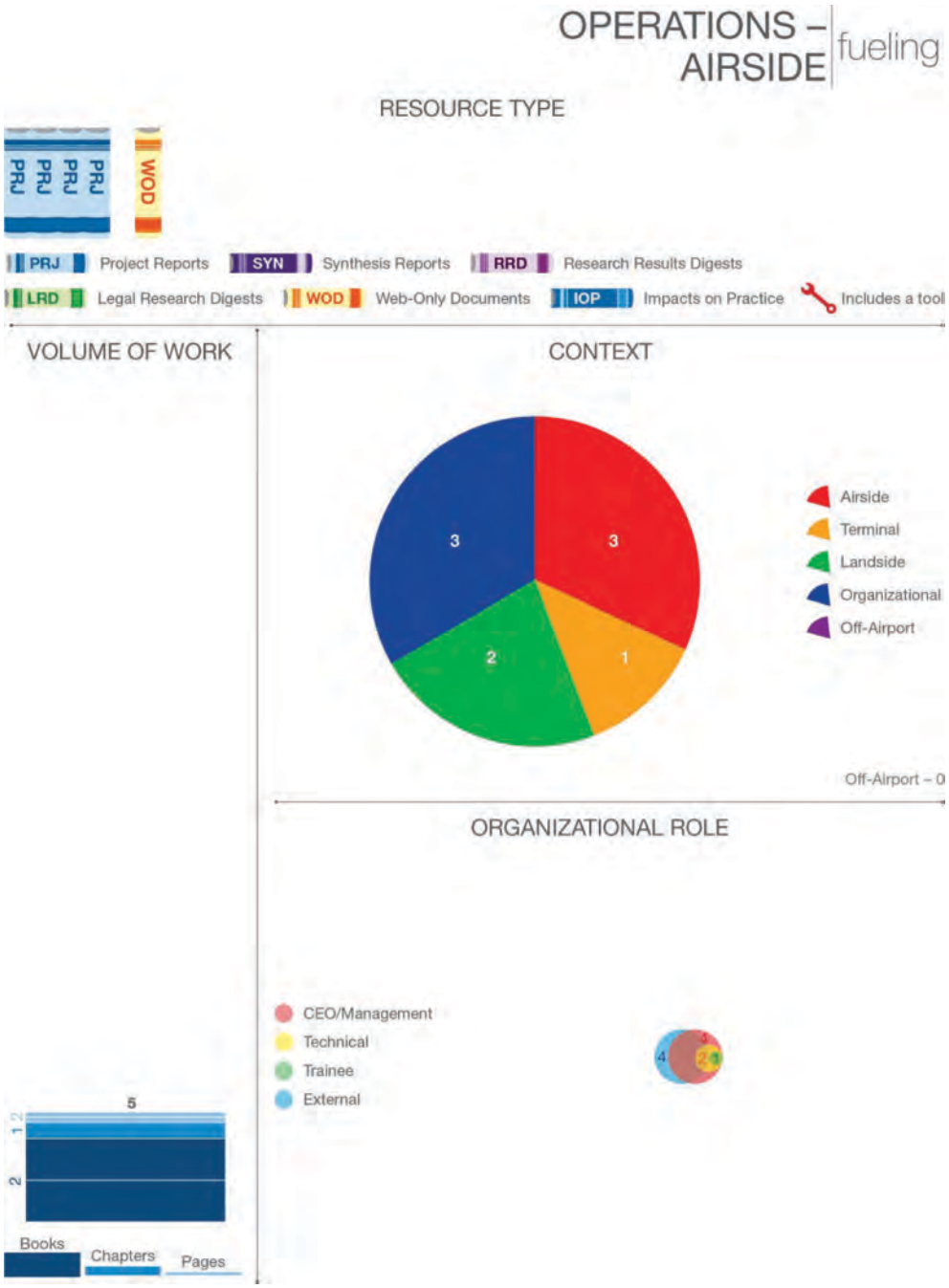


Figure 27 Scorecard—fueling.

To date, the available ACRP literature related to this sub-topic consists of four project reports and one WOD, all of which is related specifically to alternative fuel use at airports. No tools are provided in this category, and with the exception of alternative fuel use, minimal research has been completed on the fueling process and safe practices. Contextually, the majority of the resources have been written for the airport organization as a whole, followed by airside, landside, and then the terminal area. This is not surprising, given that available research is aimed at the incorporation of alternative fuel at a conceptual level for consideration by an airport rather than specific practices or processes to be followed by operations staff related

to safe fueling practices. The main audience for the published resources is an even split between management and external individuals or organizations, with limited application to technical/professional staff and trainees.

Observations. The ACRP resources published to date address fueling at both large and small airports; however, areas remain that appear worthy of further research in both cases. Fuel emissions as a whole seem to have been well researched. Suggested areas for future research include:

- Implementing fueling programs at small airports;
- Maintaining fuel storage and disbursement at airports;
- Maintaining fuel systems at large airports;
- Inspection of fuel storage facilities and fueling operations; and
- Cleanup after fuel/oil spill incidents.

In addition, it is suggested that other industries be monitored to anticipate change drivers to aviation fueling. Changes in the energy field might prompt the use of alternative fuels in either aircraft or airport ground vehicles. Changes in the fields of technology or transportation may also drive changes in aviation fueling practices.

Operations—Airside | Fixed Base Operators

This sub-topic covers subjects related to FBOs and their operation, such as aircraft maintenance and general aviation services. Fueling topics are covered in separate categories, so they are not included as part of this sub-topic. A scorecard for FBOs is not given in this digest because to date no ACRP publications have been published regarding FBOs and their operation.

Summary. FBOs are commercial businesses that are located on an airport and provide aeronautical services, such as fueling, tie-down and parking, aircraft rental, aircraft maintenance, flight instruction, and more. This sub-topic covers issues related to FBOs and their operation. Fueling topics are covered separately.

Observations. Given that no ACRP publications currently address FBOs and no other well-known industry source has been identified for FBO information, it is suggested that a project be undertaken on establishing, maintaining, and operating an FBO at a small airport. Ideally, this resource can be continually updated to reflect changes in the aviation industry specifically related to FBOs.

Areas to consider for potential future research include:

- The airport's role with FBOs (operating directly, using a management contract, or providing a lease to private entities);
- The recent consolidation trend of smaller FBOs being acquired by larger, well-established FBOs such as AvFlight and Signature; and
- Financial viability of FBOs.

Operations—Airside | Irregular Operations

Irregular operations (IROPS) covers issues related to irregular operations and the comprehensive operational response. The scorecard for IROPS is presented as Figure 28.

Summary. IROPS could be described as operations that cover situations involving the unexpected—unexpected people, in unexpected places, at unexpected times.

Figure 28 Scorecard—IROPS.

Resources containing knowledge and practice related to planning and responding to IROPS situations are cataloged in this section of the inventory. Resources for fostering collaborative and cooperative relationships with service providers are included. IROPS situations can be caused by severe weather, power outages, natural disasters, terrorist attacks, and other events.

Although IROPS are nothing new, the concept of IROPS has become a recent hot-button issue due to the relatively recent FAA regulations on tarmac delays. Coupled with FAA regulations, several weather-related incidents have occurred in recent years to bring IROPS planning and impacts to the forefront. Because IROPS is a relatively

new area of focus for research, only two ACRP documents have been published on it; however, the published resources are thorough in their investigation and provide crucial guidance to airport operators and service providers, particularly *ACRP Report 65: Guidebook for Airport Irregular Operations (IROPS) Contingency Planning.* Two projects currently in progress also address IROPS from a business perspective.

The guidance provided has been written for both management and trainee audiences, with some application to technical/professional staff. The resources cover the airside, terminal, landside, and organizational contexts evenly.

Observations. Although published ACRP resources covering IROPS are limited in number, they specifically relate to the sub-topic and seem to cover the necessary elements of this sub-topic. Updates to these resources are recommended to keep the guidance current as regulations and applicable technologies evolve.

Operations—Airside | Aircraft Rescue and Fire Fighting/Emergency Response

This sub-topic covers issues related to emergency response, including ARFF, medical emergencies, fire and rescue, and emergency response to security threats. The scorecard for ACRP ARFF/emergency resources related to airside operations is presented as Figure 29.

Summary. Guidance and practice related to on-airport emergency response, including ARFF, medical emergencies, fire and rescue, and emergency response to security threats are cataloged in this sub-topic.

Given the numerous aspects of emergency response, ARFF/emergency response crosses over several sub-topics. For example, some resources that cover the financial issues related to providing ARFF services also are cataloged under airport financial management, and some resources addressing coordination with emergency response service providers on and off the airport also are cataloged under IROPS.

Nine ACRP resources are cataloged under this sub-topic, the majority of which are written for the management audience. As expected, the main context of the guidance is for the airside areas and the airport organization as a whole, followed by landside, then terminal and off-airport areas. Various resource types have been published, including one tool.

Observations. ACRP resources are available on aircraft recovery, helping employees cope with traumatic events, and IROPS, but there appears to be a lack of documentation on airport emergency response plans, methods, coordination with mutual aid, and command/control/communication.

Additional areas for potential research include development of documentation addressing specific ARFF issues, such as the following:

- Providing ARFF at smaller airports,
- How to staff ARFF departments,
- How airports are accommodating newer and larger ARFF equipment,
- Benefits and disadvantages of ARFF procurement methods,
- How airports are financially justifying consolidated ARFF/SRE buildings,
- New fire extinguishing agents and methods, and
- ARFF training.

Operations—Airside | Non-Movement Area Operations

Non-movement area operations involve concepts related to coordination in the non-movement area with activities typically performed by private/commercial

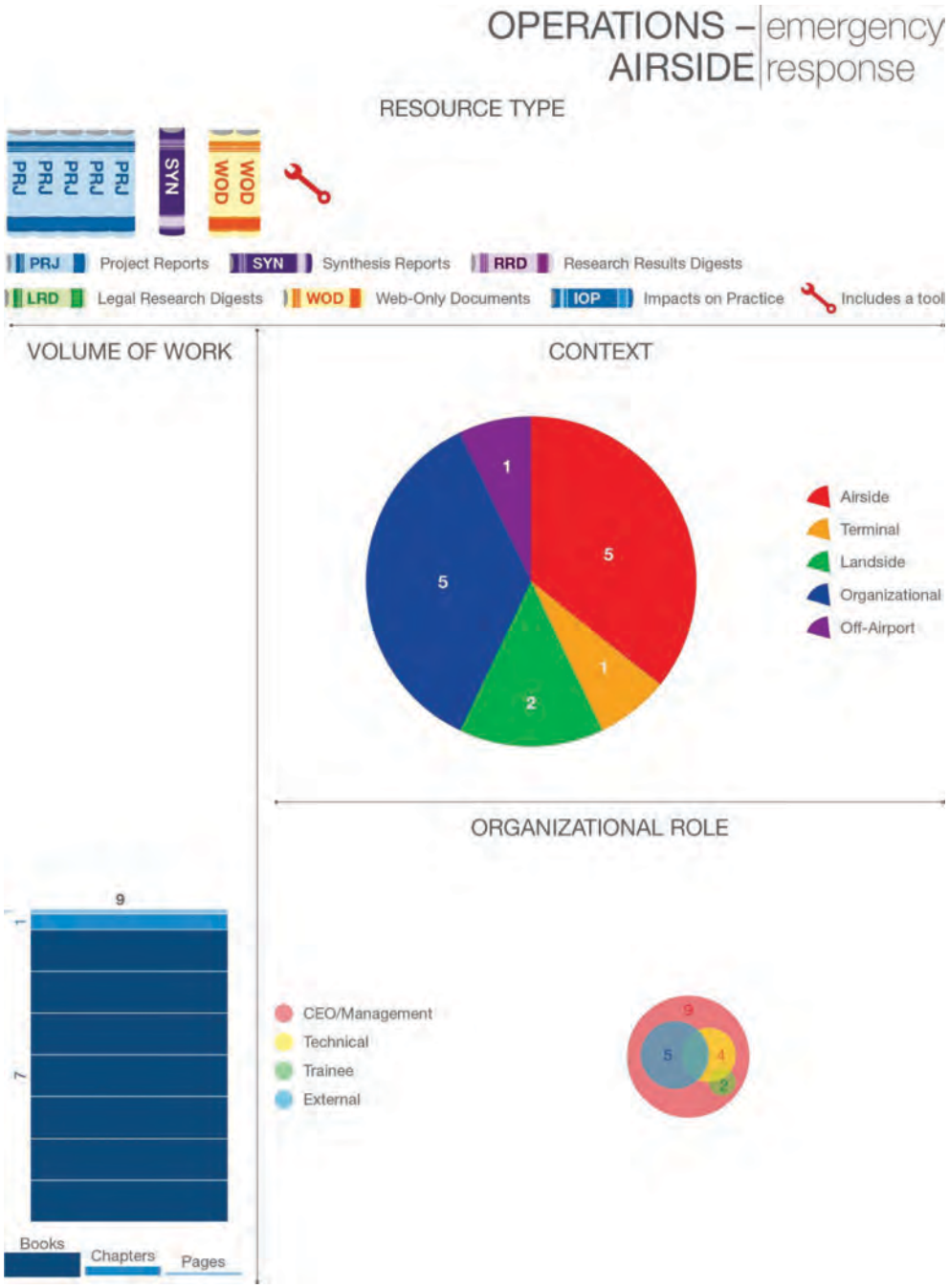


Figure 29 Scorecard—ARFF/emergency response resources related to airside operations.

airlines, commercial cargo services, and government agencies (e.g., fire fighting, military, natural resources). Airside operations activities of this type are monitored by airport operations staff but typically are carried out by personnel who are not employees of the airport. The scorecard for non-movement area operations is presented as Figure 30.

Summary. This part of the inventory catalogs guidance and practice related to coordination in the non-movement area and includes activities typically performed by

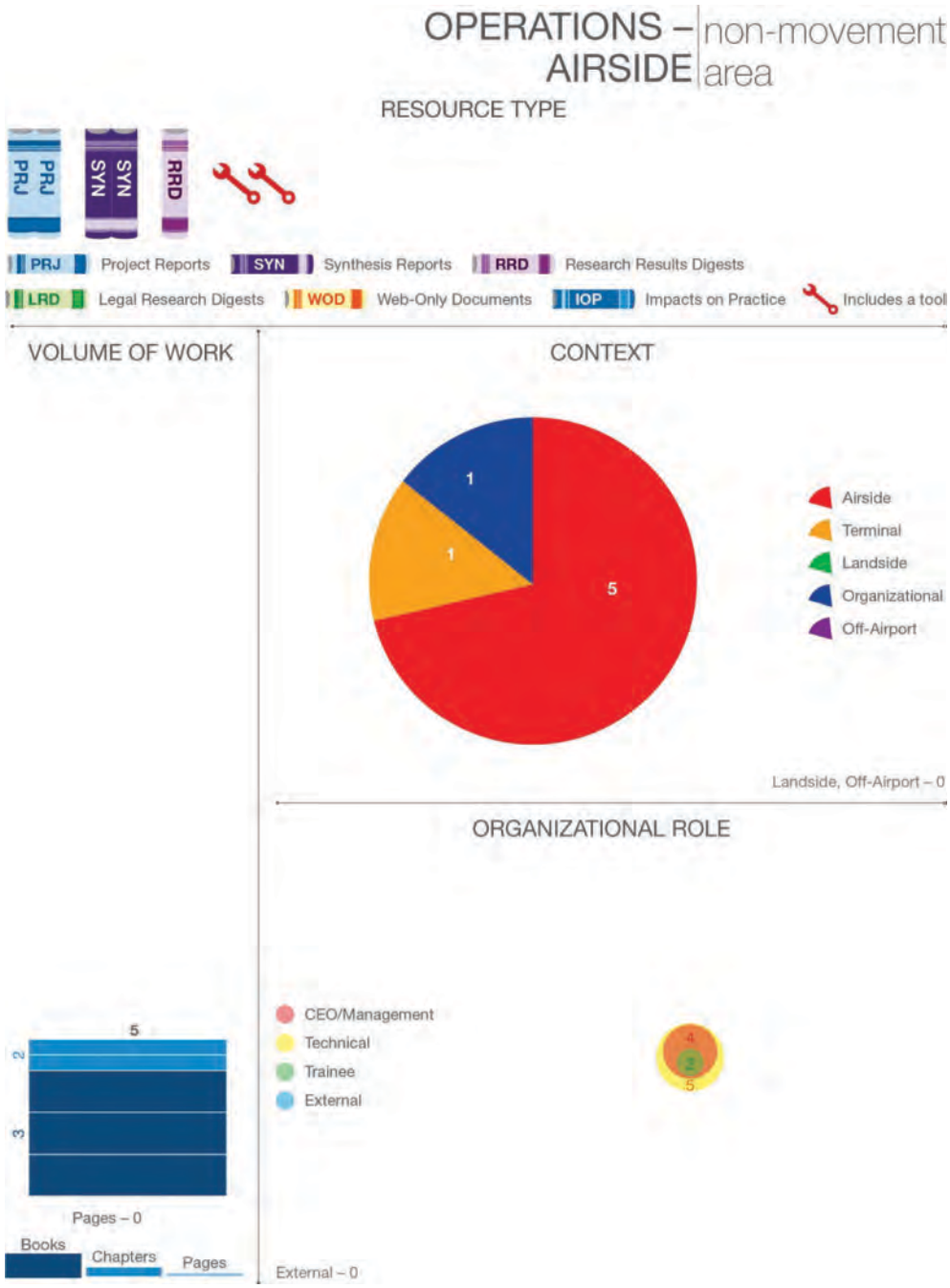


Figure 30 Scorecard—non-movement area.

private/commercial airlines, commercial cargo services, and government agencies (e.g., fire fighting, military, natural resources). These activities are monitored by airport operations staff but typically are carried out by personnel who are not employed by the airport.

Depending on the size and type of operations at an airport, the activities covered in this sub-topic may be carried out by one or two staff members who have been trained in apron operations, or they may be completed by staff of a large airline that are fully dedicated to this task.

Although only five resources were cataloged under this sub-topic, it appears to be well covered to meet current needs. The main audience is technical/professional staff, followed by management. As expected, the majority of the guidance is written for the airside area. A variety of resource types is available, including two tools.

Observations. It is important to have up-to-date guidance on non-movement area operations because rules, regulations, processes, and equipment periodically change. For example, *ACRP RRD 15: Use of Towbarless Tractors at Airports—Best Practices*, published in 2012, could become a candidate for updating to reflect future changes in technology or practices, as appropriate.

Additional suggestions for future research include:

- Ground handling operations at small commercial service airports;
- Installation, maintenance, and operation of jet bridges; and
- Security/safety of apron operations at large airports.

Operations—Airside | Airfield Inspection and Maintenance

Airfield inspection and maintenance covers issues related to the inspection of safety areas, pavement surfaces, and signs/marking/lighting. At some airports, this sub-topic includes compliance with Part 139 standards. The scorecard for airfield inspection and maintenance is presented as Figure 31.

Summary. Guidance and practice related to the inspection and maintenance of safety areas, pavement surfaces, and signs/marking/lighting are included in this sub-topic. At some airports, this includes compliance with Part 139 standards.

Airfield inspection and maintenance activities are carried out daily by airport operational staff to ensure the safety of aircraft operations. Several components require inspection, including checking pavement for FOD and cracking, ensuring that safety areas are clear of obstructions, and maintenance of appropriate lighting for working operations.

With 18 resources, this sub-topic has the most resources of the eight sub-topics under Operations-Airside. A wide variety of resource types are classified in this section, but no tools are available. The majority of the resources are written for the technical/professional and management staff, with several addressing trainees. As expected, the context for most of these resources is airside.

Observations. Several aspects of airfield inspection and maintenance are well covered by published ACRP resources, including signage guidelines for terminals and landside areas, maintenance-related issues within commercial passenger terminal buildings, and pavement maintenance and FOD inspections. However, several concepts are missing from the existing research literature. Areas of potential future research include:

- Documentation on marking, signing, and lighting during construction activity;
- Snow melt issues with LED lights;
- Coordination with public entities to establish wayfinding to airports on public roadways;
- Snow/ice removal;
- Pavement maintenance;
- How to create and maintain a pavement management system;

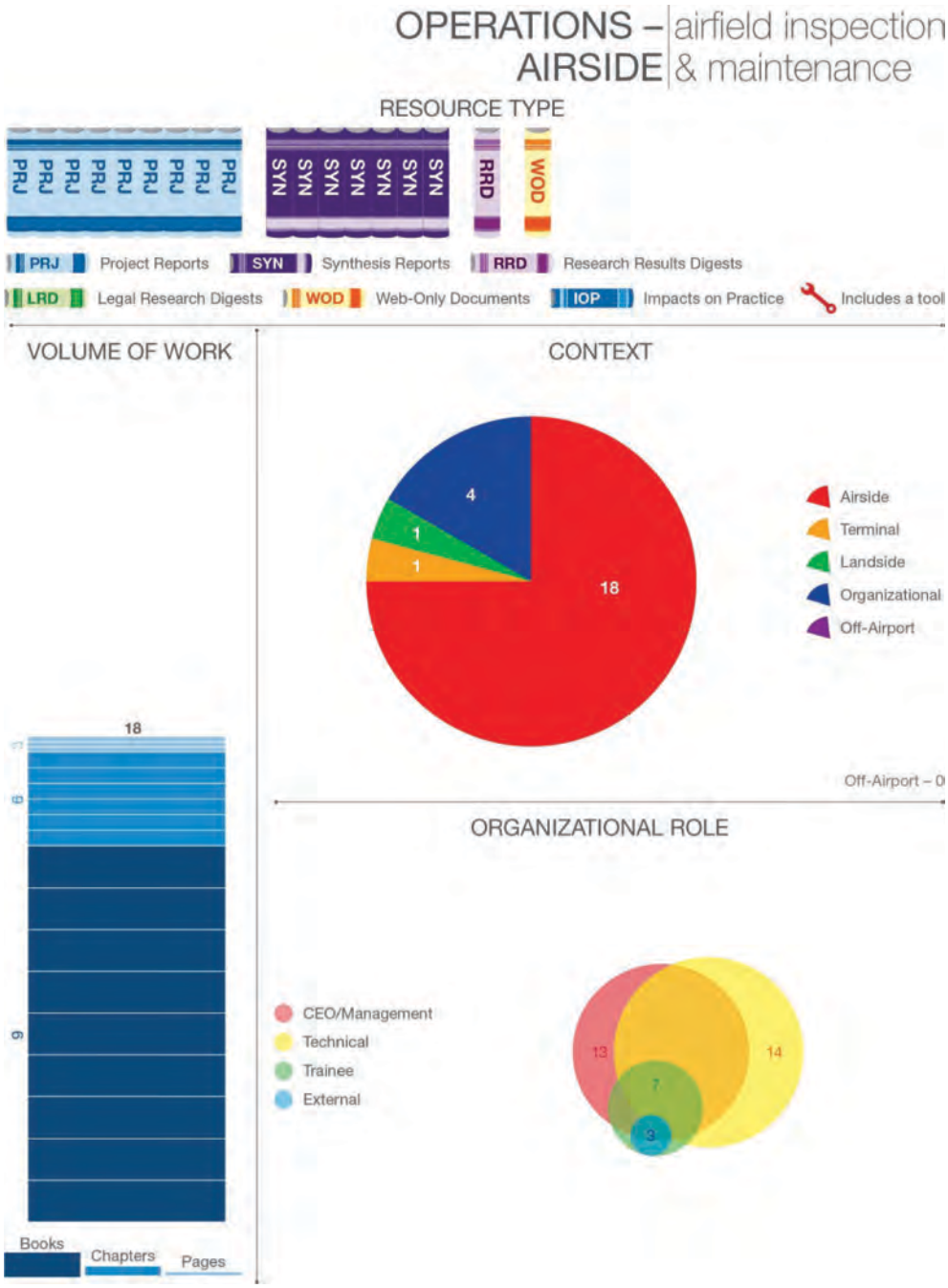


Figure 31 Scorecard—airfield inspection and maintenance.

- Maintenance of Engineered Material Arresting Systems (EMASs), approach/departure surfaces, and mitigation of obstructions; and
- Coordination of construction activities within safety areas (best practices).

Operations—Airside | Wildlife Hazards

This sub-topic includes concepts related to the control and mitigation of wildlife on and adjacent to airport property. The scorecard for wildlife hazards is presented as Figure 32.

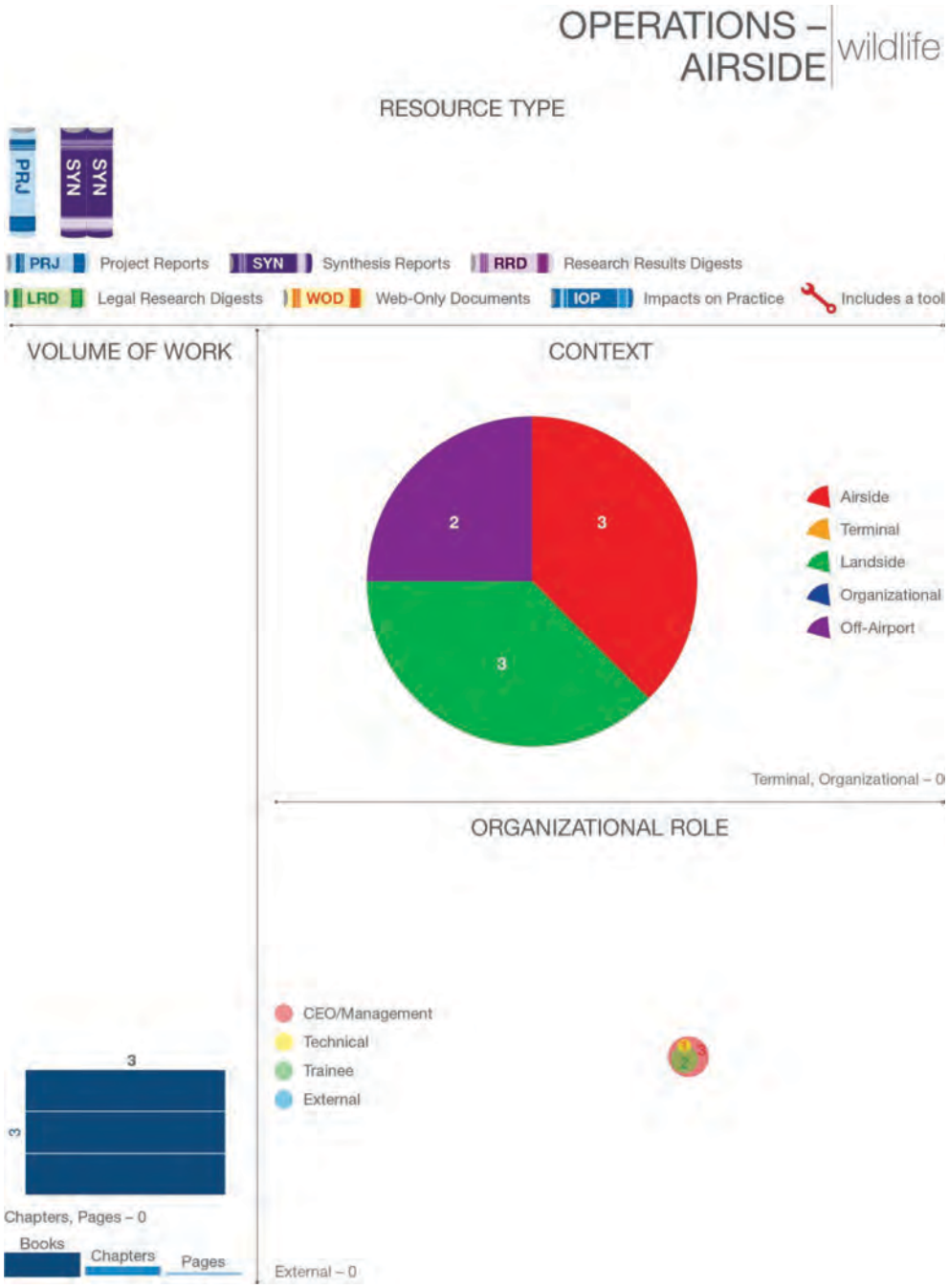


Figure 32 Scorecard—wildlife hazards.

Summary. Resources on the knowledge and practice related to the control and mitigation of wildlife on and adjacent to airport property are cataloged under this sub-topic. Maintaining a safe operating environment for aircraft is the number one priority for airport operational staff. One of the major threats to that safety is the presence of wildlife on or near an airport.

Three ACRP resources address wildlife from an operational standpoint, and no tools are provided. Literature on this sub-topic has been written primarily for management and secondarily for trainees. Contextually, the research is split between airside and landside, with some resources related to off-airport areas. This is not

surprising, because managing wildlife hazards requires a combination of techniques both on and off the airfield.

Observations. Published in 2011, *ACRP Report 32: Guidebook for Addressing Aircraft/Wildlife Hazards at General Aviation Airports* is the largest ACRP resource to date on this sub-topic. It is a comprehensive resource on current wildlife hazards and management, but it will be important to keep the information updated as new techniques are developed and approved for use. Overall, this topic appears to be well covered by the existing literature.

FOCUSED INVESTIGATIONS

To complement the inventory of published research, the ACRP engaged two consulting firms to conduct separate, focused investigations to develop various conceptual elements of Project 11-07, collect research ideas, and identify major challenges facing the airport industry. These investigations consisted of outreach teleconferences and a targeted workshop.

Outreach Teleconferences

The research team conducted 11 outreach teleconferences with focus groups consisting of practitioners representing six TRB Aviation Group committees and five committees from industry associations. A primary goal of the teleconferences was to collect research ideas in specific topic areas. The 11 teleconferences were held between February 4, 2013, and March 4, 2013, and involved more than 100 industry practitioners. Written meeting summaries highlighting the identified research ideas and needs were prepared and distributed to all participants. TRB Aviation Group committees were encouraged to submit top priority research needs to the TRB database.

The research team took high priority research ideas from each of the teleconference meeting summaries and worked with industry stakeholders to develop problem statements for ACRP research. On behalf of the committees, participants, and stakeholders, the research team submitted 14 problem statements to ACRP for consideration at the July 2013 AOC project selection meeting.

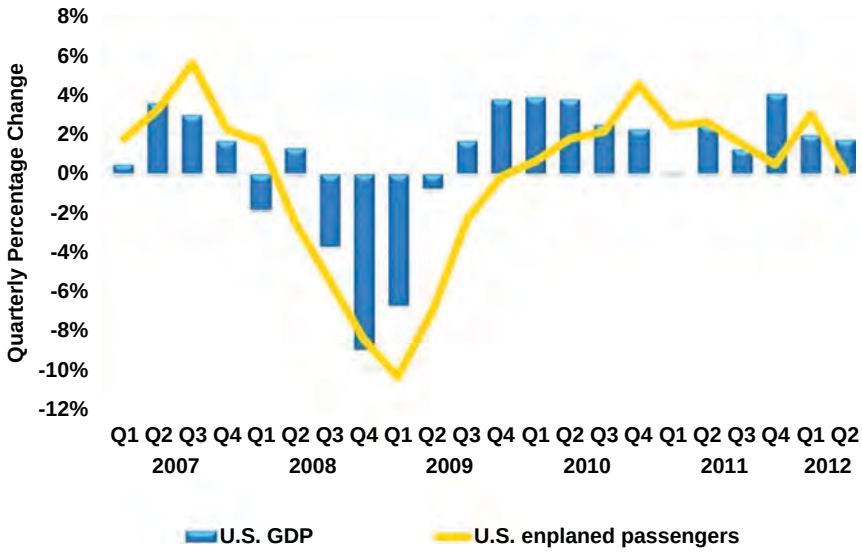
The 11 outreach teleconferences enlisted feedback from the following organizations:

- AAAE Administration and Finance Committee;
- AAAE Operations and Maintenance Committee;
- AAAE Public Safety and Emergency Management Committee;
- ACI-NA Administration and Finance Committee;
- ACI-NA Environmental Affairs Committee;
- TRB Aviation System Planning Committee (AV020);
- TRB Environmental Impacts of Aviation Committee (AV030);
- TRB Airport Terminal and Ground Access Committee (AV050);
- TRB Airfield and Airspace Capacity and Delay Committee (AV060);
- TRB Aircraft/Airport Compatibility Committee (AV070); and
- TRB Aviation Security and Emergency Management Committee (AV090).

November Workshop

On November 14, 2012, the research team facilitated an in-depth, on-site workshop for AOC members and 23 industry experts who fully represented the wide range of aviation interests and ACRP stakeholders, including airports, airlines, general aviation, researchers, academicians, consultants, and others.

The workshop opened with a presentation of a series of airport and aviation metrics, which encompassed a range of material requested by ACRP staff and in the course of the background interviews conducted with workshop participants. The presentation included several slides that summarized changes in aviation traffic and seat capacity that have significantly altered the domestic and international flow of traffic. The workshop generated new ideas



Source: OAG (online).

Figure 33 Domestic passenger growth tracks economy, 2007 through mid-2012.

through a 1-day facilitated discussion of global and domestic social, demographic, technological, regulatory, operational, and environmental megatrends that focused on anticipating and identifying new demands and challenges facing airports and the airport transportation system. The discussions focused on the following areas:

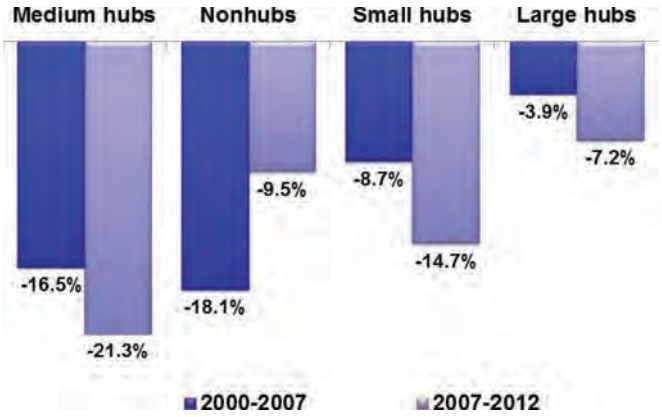
- Domestic passenger growth,
- Air service challenges at smaller airports,
- Growth of regional air service and global airline alliances,
- Changing patterns of global air service,
- FAA funding, and
- Airport funding constraints.

Domestic Passenger Growth. Although the U.S. economy has recovered from the severe recession of 2008–2009, domestic passenger growth remains modest, challenging many airports (Figure 33).

Air Service Challenges at Many Smaller Airports. The distribution of traffic across the aviation network has changed significantly over the last decade, with larger airports experiencing fewer reductions in seat capacity and smaller airports (i.e., those below the size of large hubs, which are defined as airports having more than 1% of the national enplanements) suffering large drops in scheduled seats (Figure 34).

Growth of Regional Air Service and Global Airline Alliances. With the exception of North America, every region of the world experienced an increase in seat capacity between 2000 and 2011. The three global airline alliances—Star Alliance, Oneworld, and SkyTeam—have captured an increasing share of domestic and international traffic in each of the world's regions (Figure 35).

Changing Patterns of Global Air Service. A decade ago, the North American and European regions controlled the vast majority of global aviation demand



Source: OAG (online).

Figure 34 Changes in scheduled seats in larger and smaller airports, 2000–2012.

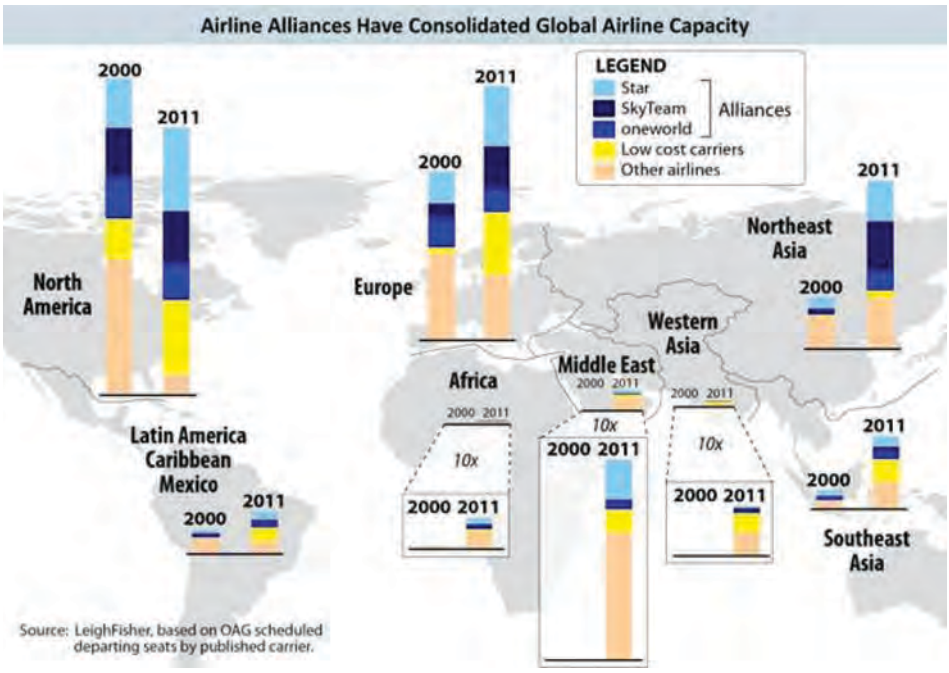


Figure 35 Regional air service and global airline alliances, 2000 and 2011.

due to their large economies, the propensity of their citizens to travel, strong home-based airlines, and domestic demand. By July 2012, however, the global aviation system had become more multi-polar, with rapidly increasing demand in Northeast Asia, Southeast Asia, Latin America, the Caribbean, Mexico, and the Middle East (Figure 36). This new, more balanced global system has strong domestic demand in several regions that today feed increasing numbers of international flights, enabled by longer range aircraft and market liberalization.

FAA Funding. In recent years, the Airport and Airway Trust Fund (AATF) has faced a decline in receipts

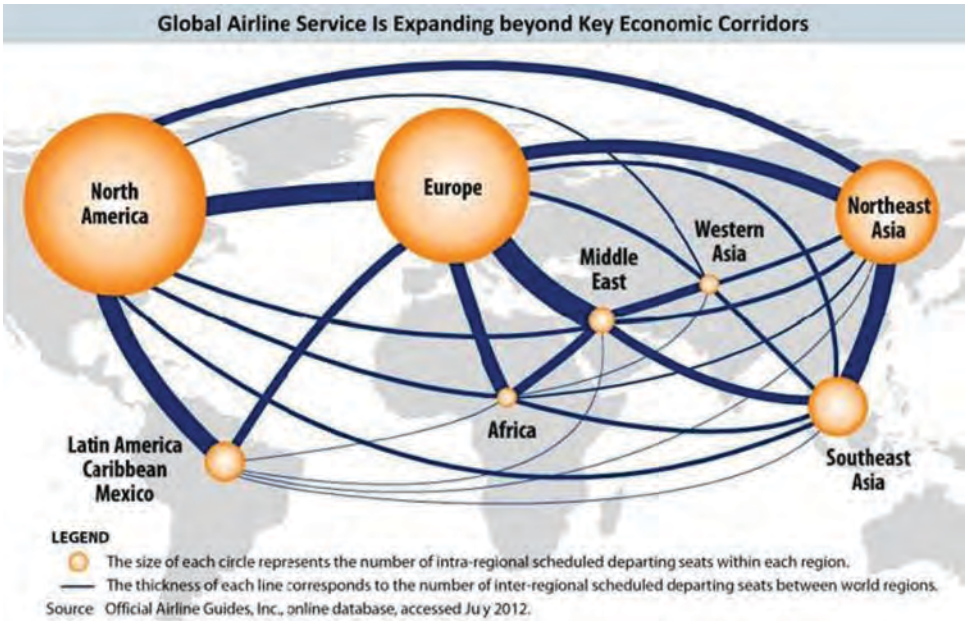
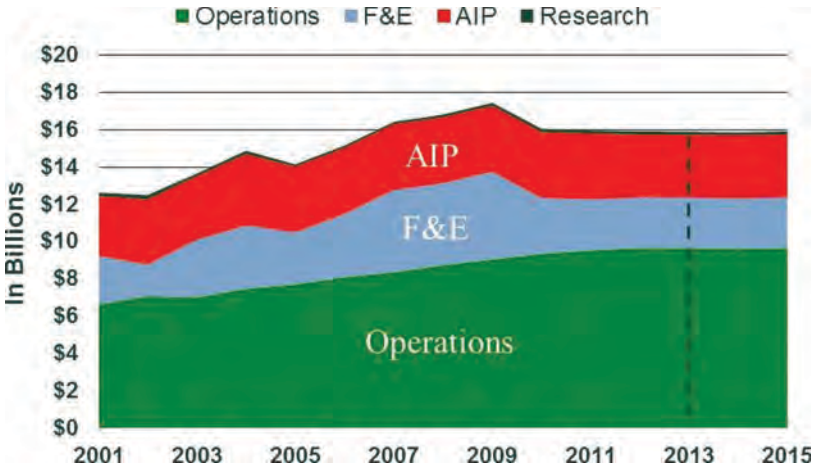


Figure 36 Global patterns of air service demand, 2012.



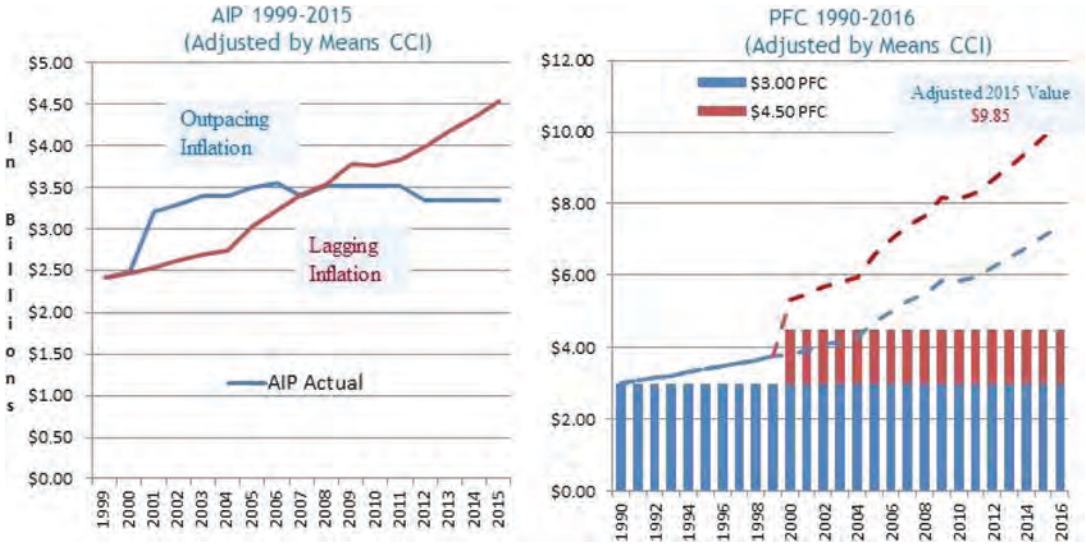
Source: OAG (online).

Figure 37 FAA budget for major program functions, 2001–2015.

generated by the industry, resulting in constraints on the FAA's budget over the last decade (Figure 37). These constraints have arrested the historic growth in capital grants awarded to airports through the Airport Improvement Program (AIP), or through the Facilities and Equipment Account (F&E) that funds capital equipment for the FAA, and have promised to constrain future spending in the account that funds a portion of FAA's cost to operate the system.

Airport Funding Constraints. Federally authorized but locally assessed passenger facility charges (PFCs) also have faced significant pressure in recent years (see Figure 38). Together with the tightening of funding available for AIP capital grants, this has meant fewer resources for airports to pay for capital projects, leading to enhanced pressure on recovering additional costs from airlines through aeronautical revenues and delay or cancellation of many projects.

Examination of these megatrends suggests that the U.S. aviation industry today is a dynamic industry characterized by perpetual restructuring. Over the last decade, the combination of economic shocks, high fuel prices, air carrier mergers, and industry consolidation has brought significant change to the



Note: The Means CCI is an annual construction cost index.

Figure 38 Airport funding constraints.

commercial airline industry and general aviation. From an industry standpoint, these factors have resulted in a shift from historically predictable traffic and passenger levels (and the reliable revenue streams to support them) to an industry characterized by economic threat and uncertainty. In this environment, many small commercial service and general aviation airports have experienced severe losses in service, even as other airports have found themselves dealing with capacity constraints and congestion.

CONSOLIDATION OF RESEARCH IDEAS BY THEME

Taken together, the inventory of ACRP research literature, the teleconferences, and the AOC's November workshop yielded more than 100 specific research ideas that reflect industry perceptions of needed knowledge and practice. By eliminating those research ideas already covered or not well suited to ACRP research and consolidating duplicates, the remaining proposed ideas can be grouped thematically. The next sections of this digest present a consolidation of the proposed research ideas under 14 themes:

- The economy and its implications,
- Airline industry and air service,
- Airports and air service,
- Airlines' business models,
- Airports' business models,
- Airport management models,
- Airports in the intermodal transportation system,
- National Airspace System/NextGen,
- General aviation,
- Management and workforce,
- Energy and fuels,
- Sustainability and climate change,
- Government regulators and service providers, and
- Congestion management.

The Economy and Its Implications

This theme is characterized by estimates of modest growth in the gross domestic product (GDP) and the implications of such modest growth for aviation demand. Pressures for austerity policies in the face of federal deficits and debt are causing a decline of public investment and subsidies, which in turn is causing declining balances in the AATF. Consequently, constraints on the AIP and other trust-fund programs are creating a degree of uncertainty for future capital funding. Proposed research ideas grouped under this theme include:

- Measuring economic impacts and economic contributions, and
- Economic geography of airports, including catchment areas.

Airline Industry and Air Service

Within the aviation industry, apparent reductions of air service to non-gateways and a decline in the use of regional aircraft pose a threat, especially to small communities. It is anticipated that the growth of ultra-low-cost carriers, the consolidation of legacy carriers, and worldwide alliances will continue to affect demand, travel, and competition; however, the full implication of these changes for airports remains unclear. Proposed research ideas consolidated under this theme include:

- Liberalization, including measures to reduce limitations on domestic airline service;
- Relaxation of international ownership and control restrictions; and
- The general decline in competitiveness of U.S. airlines.

Airports and Air Service

This theme is characterized by the dynamic change being seen throughout the industry and divergence of the largest and smallest airports. For example, traditional airside infrastructure needs are growing at the largest airports as traffic is channeled through gateway international airports. At the same time, needs are shrinking at smaller airports. Prevalent business strategies target retention of existing air service and expand services of incumbents. Smaller airports need new models to encourage air service development and new market entry. Smaller

airports are competing with other airports for service and aeronautically related business. A strategic approach is needed to prioritize regional airports (to concentrate air service opportunities to fewer airports) and to find sensible ways to balance the service versus investment risk with uncertainty of air service levels. Proposed research ideas grouped under this theme include:

- Gate management,
- Consortium management of electronic data systems (EDS) for display of flight and baggage information,
- Evolving technology and capacity,
- Idle thrust reversal landing procedure,
- High load factors and congestion,
- Uses and effectiveness of surface tracking systems,
- Wingtip collisions involving aircraft or terminal-area wingtip collisions,
- Airfield lighting—LED brightness or pilot perception of LED lighting,
- Maturity models for runway safety,
- Property acquisition costs related to RPZ standards,
- Inexpensive fog detection systems,
- Severe weather detection and warning at airports,
- Effects of weather on capacity,
- Techniques for measuring aircraft braking on the airfield,
- Airfield vehicle tracking systems, and
- Uses and effectiveness of surface tracking systems.

Airlines' Business Models

Several subjects suitable for potential research can be grouped within this theme. For example, there is a growing concern that the industry is subsidizing international travel (e.g., the costs of U.S. Customs Federal Inspection Services facilities) on the backs of the domestic market. Airports recognize public demand for new and revised practices in aircraft operations (e.g., environmentally responsible practices, such as the use of single engine taxiing, electronic motors) and wish to assess the impact of airline ownership of refineries and their enhanced control of the energy supply chain. Opportunities exist for partnering with carriers as they explore changes in baggage policies and third-party services. Airports seek to understand the implications of airlines' business models for business planning. One broad research topic within this theme is "airports and airlines—keys to a successful partnership."

Airports' Business Models

This theme is characterized by a need to understand new models for airport infrastructure funding and finance and how, amid current uncertainties, they may play into airlines' usual concerns about increases in airport costs. New possibilities exist for airport privatization and for increases in private capital. Emerging innovative business practices offer possibilities for greater commercial business development and realization of the aerotropolis concept. Financial markets are changing, and airports need to know the impact of hedge fund ownership of FBOs and exclusive FBO deals. Proposed research ideas grouped under this theme include:

- Integrating commercial space into normal airport operations,
- Life cycle cost analysis,
- Impact on rates and charges as PFC revenue is leveraged more,
- Return on investment report on airport best practices regarding trip fees for ground transportation,
- Best practices for parking revenue generation,
- Retail and parking related to airport revenue, and
- Common use facilities.

Airport Management Models

This theme encompasses subjects related to the industry's move toward greater use of the triple bottom line (i.e., people, planet, profit), and an enhanced model of organizational effectiveness (e.g., value for money). Traditional issues remain, such as asset management and state of good repair for airports, as well as SMS and enterprise risk management. Airports are trending toward adoption of a passenger-centric ethic that views the airport's job as facilitating commerce and service, not just the performance of airport roles. On the other hand, a general lack of responsiveness to the growing share of international travelers is apparent at some airports. Airports need to prepare for the impact of the next generation of shared use, common use, and

enhanced use of new technology. Knowledge and practice are both needed to understand and implement new models of alternative project delivery, such as construction management at risk (CM at risk) and to adapt to an increase in the airport role in the digital world (as collector, holder, and disseminator of information). Proposed research ideas grouped under this theme include:

- Entrepreneurial activities;
- Primary guidance documents;
- Primary planning documents;
- Process improvement strategies for airports;
- Electronic technology solutions for process improvements;
- Enterprise data warehouse solutions;
- How airports handle information and decision models;
- Best practices in airport ground handling;
- Best practices for re-integrating passengers back into terminals after an evacuation to expedite flights;
- Use of campus notification and lockdown system;
- Integration of public address and voice alarm systems with airline video monitors during unusual occurrences and emergencies;
- Training of non-airport personnel for response to airport emergencies;
- Perimeter intrusion detection system evaluation, or how to evaluate the benefit/cost of perimeter intrusion detection system;
- Development of a public awareness campaign intended to reduce the number of firearms at security checkpoints;
- Use of intelligent video to monitor crowd control or unattended packages in airport terminals;
- Access control technologies—viability in salt air;
- Evaluation of alternative arresting system materials;
- Behavioral analytics in an airport setting;
- Design for terminals regarding airport safety and aging populations;
- Travel needs of older Americans or travelers with disabilities, or planning, design, and operation of airports for aging airport travelers;
- Alternative delivery methods: effectiveness versus traditional method;
- Evaluation of thermoplastic airfield markings; and
- Alkali-silica reaction (ASR) remediation at airports.

Airports in the Intermodal Transportation System

Airports continue to integrate air service with multiple modes in intercity transportation systems. Airports are becoming hubs for intermodal activity or clusters of modal services where airports are using surface modes for hub connections (e.g., with drop-in, short-haul hub connections). Still, there is a need to solve the "last mile" problem (i.e., quality of airport connections). Proposed research ideas grouped under this theme include:

- Tools for understanding growth (in multi-airport regions),
- The disconnect between aviation and transportation planning,
- State of the practice,
- Multimodal planning,
- Regional system planning,
- Freight and cargo movement at and near airports, and
- Guidelines for air cargo facility planning and development.

National Airspace System/NextGen

This theme is characterized by a need to examine and publicize the benefits to airports of transitioning to NextGen satellite navigation (e.g., alternative flight paths, types of aircraft, formation flying, and impacts on capacity). Sub-topics include the impact of NextGen on smaller airports; the roles and responsibilities of airports, airlines, and FAA with regard to airside surface movements; and the future role of alternative commercial service airports (i.e., spread the traffic) and the sustainability of large numbers of public airports. Specific areas of potential research interest include:

- Ownership of airspace,
- Regulations concerning unmanned aircraft systems (UAS),
- System planning for NextGen, and
- NextGen impacts on safety.

General Aviation

Consensus exists to protect the role that general aviation provides for access and training throughout

the industry. Yet, it appears necessary to prioritize regional general aviation airports in order to concentrate resources and traffic in sensible ways. General aviation airports need to be made aware of the impact of NextGen on provisions of services to general aviation users and airports. One area of potential research interest within this theme is risk assessment of general aviation in areas adjacent to airline secured areas and reasonable control methodologies.

Management and Workforce

A need continues for guidance on succession planning best practices. Airports are concerned about pension costs and future obligations that will require costs to be recovered. They need to create a more flexible workforce and import more HR practices that are used in other kinds of businesses (e.g., contracting out, using part-time workers, and managing costs). Proposed research ideas grouped under this theme include:

- Recommended staffing levels for airside operations,
- Effective policies and training for employee succession,
- Training materials for airport operations staff for FAR 139 operations,
- Utilizing and maintaining aircraft for training,
- Active shooter situations in airport emergency plans,
- Guidance for airport emergency response and exercises,
- Best practices for providing realistic training during a full-scale emergency exercise on a small budget,
- Best practices for training employees to assist with terminal evacuations,
- Retention of security personnel to reduce proliferation of airport security protocols,
- Updating/revising personal protective equipment for law enforcement officers and ARFF/emergency medical services personnel, and
- Safety training at airports.

Energy and Fuels

Continued unpredictability regarding the supply and cost of fuels creates pressures that have implications for airports. Alternative energy sources (e.g., biofuels) are coming, but the consequences and possibilities of such energy sources for airports are unclear. Another focus within this theme is the uncertain world of the airport as an energy producer (i.e., the benefits and costs of on-airport capital investments, airports' access to the grid, and state and local rules governing energy production) and enhanced pressures for integrating market externalities into the aviation business (which connects this theme with sustainability). Consolidating these ideas, one area of potential research that may assist airports as they look toward the future is:

- Best practices for fuel farm management.

Sustainability and Climate Change

More information is needed to understand, mitigate, and avoid climate change impacts at airports. Policies, such as taxing carbon emissions, carbon trading, and policies of the International Civil Aviation Organization (ICAO), a specialized agency of the United Nations, also will affect airports and air service. At the same time, public expectations are increasing regarding the sharing of environmental impacts (air, water, and climate). Proposed research ideas grouped under this theme include:

- Sustainability—How to integrate an organization-wide sustainability plan for airports, with examples of airports that are addressing sustainability;
- Cost-effective airside deicers;
- Runway lighting protection from water;
- Paperless inspections/green initiatives for airports;
- Putting the National Environmental Policy Act (NEPA) into the long-term planning process, or addressing sustainability as it relates to more efficient master planning;
- Developing an environmental management system;
- Climate change adaptation—Asset management in the face of increasing and stronger storms, and hardening of infrastructure;
- Guidance document on interpretation of airport water quality results/monitoring data;
- Guidance document for airport water conservation planning and water conservation programs;
- Successful, cost-effective wetland and stream mitigation efforts, including effective construction of stormwater management tools and

stormwater/deicing technologies to reduce discharge of deicing fluids to the environment;
- Alternative anti-icing runway systems;
- Sea level rise and shoreline protection for airports;
- Aerial deposition of brakes, rubber, and metals on airport runways; and
- Best practices for investigating, responding to, and tracking noise complaints.

Government Regulators and Service Providers

Improvement is needed in how the aviation industry manages uncertainty with forecasts, an area with implications for the National Airspace System (NAS), and the environmental review process is always a challenge. Adding capacity in critical locations throughout the world continues to be difficult, yet the industry needs to adapt to globalization and international movements. Aviation can benefit by finding ways to improve security checkpoints, operations research, and levels of service. Proposed research ideas grouped under this theme include:

- Obtaining FAA funding;
- An evaluation of technology standards in airport emergency operations centers (AEOCs);
- Critical infrastructure needs at airports;
- Airport emergency disaster preparedness standards;
- Consistent reporting by airports/safety data reporting/airport safety data collection;
- Monitoring and control technology for sterile area exit lanes;
- Law enforcement officials' use of non-lethal weapon systems;
- Effective cybersecurity management;
- Reducing the occurrence of banned substances and objects at airport security checkpoints;
- Guidance for sound insulation compliance;
- Rocket noise;
- Ground surfaces and noise models;
- Assessing whether biometric technologies are advanced enough to justify the costs (an assessment of current technologies that are widely used);
- Perimeter intrusion detection system evaluation;
- On- and off-campus notification systems; and
- Mobile command vehicles—best practices for implementation and utilization.

Congestion Management

The emerging practice of collaborative decision making may reduce tactical delays and improve service levels. Airports should understand clearly how the FAA conducts slot allocation (strategic rights to service) and how it coordinates international and national congestion policies among the appropriate authorities (ICAO, United States/European Union). Understanding how airports can use peak-period pricing and making better use of scarce airport capacity also can benefit from additional research. Proposed research ideas grouped under this theme include:

- Defining delays, and
- Optimization of flight operations at airports.

FIVE HOT TOPICS (CHALLENGES)

As a next step in defining the challenges facing airports and the aviation industry, the participants at the November workshop compared the megatrends identified under these 14 themes with a similar inventory of critical issues that had been identified from a similar discussion in 2008 and published as *ACRP RRD 5: Current and Emerging Issues Facing the Airport Industry* in January 2009. Figure 39 summarizes the comparison.

Five actionable research challenges were subsequently identified, as described in the following sections.

The Changing Aviation Industry and Airports

Aviation and airport leaders today face a consolidated industry that is not producing the growth in markets, seats, and passengers forecast just over a decade ago. Add to this the related uncertainty of

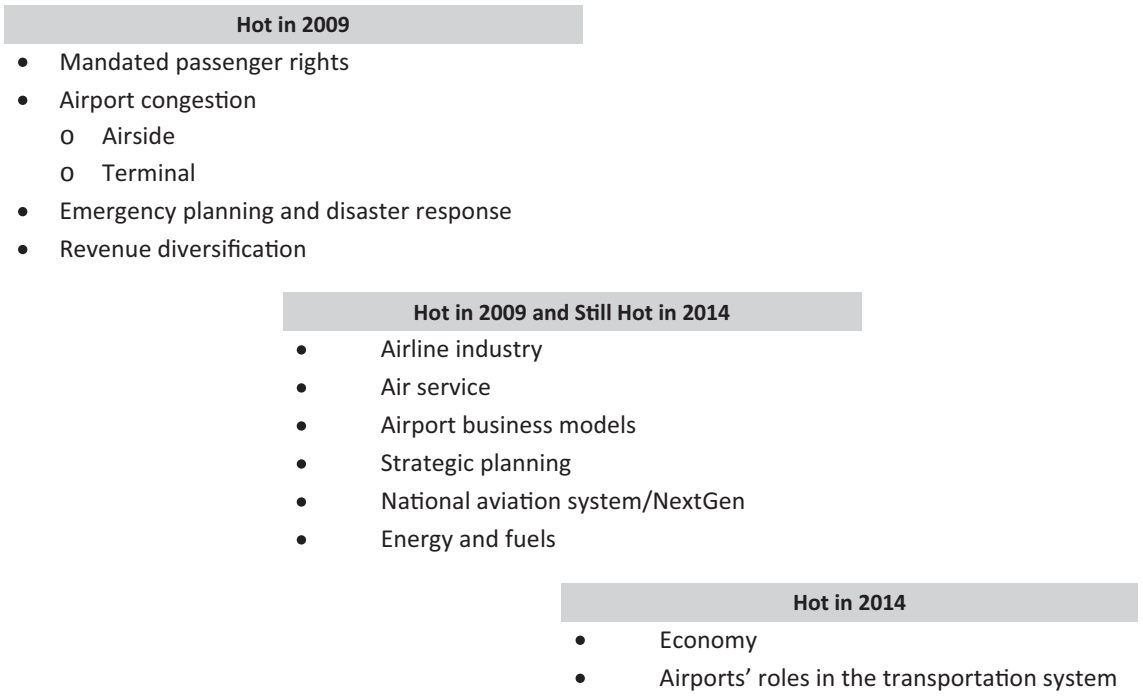


Figure 39 Hot Topics—2009 versus 2014.

funding sources for capital projects, and the business model clearly has begun to change from a public model to one that has many attributes of a commercial business. For many smaller commercial service and general aviation airports, funding uncertainties and steeper declines in traffic and operations threaten their continued existence. All of these trends challenge airports to better understand the industry around them and to reorient their internal operations around new sets of strategic goals.

Given this challenge, strategic priorities for research address the following areas:

- Evaluating and developing the business case for airports in today's industry:
  - The impact of a consolidated, slower growing airline industry and changes in the distribution of traffic on airports ranging from large gateways to smaller regional airports;
  - Determining the economic impact that aviation and airports provide to inform and shape the case for federal, state, and local support for airports;
  - New models of funding airports given the slower growth or drop of aviation-related revenues, real declines in PFC authority, and fiscal pressures on the AIP;
  - The importance of changing and escalating fuel prices on the viability of certain aircraft types and the impacts on air service and market viability;
  - The business case for general aviation airports in the aftermath of the FAA's asset study;
  - The potential for private capital to play an enhanced role for airports, including privatization, public-private-partnerships, and alternative project delivery;
  - The environmental challenge posed by greenhouse gas emissions, local air quality, and noise, and their impacts on airports' community standing, costs, and air service.
- Managing airports in today's aviation industry with a focus on industry level:
  - Examining what it means to be a public service airport;
  - Alternative governance and board structures, including those that can facilitate successful business practices;
  - The changes in role and expectations for airport managers in the changing aviation industry;
  - The challenge of forecasting in today's aviation industry (i.e., the days of assuming 3% growth are over);
  - The ongoing challenges of managing small airports in today's industry (e.g., rising fuel prices and declines in operations);

  - Lessons learned from Superstorm Sandy and other disruptive events; and
  - Competition among airports in overlapping catchment areas for air service and for economic development (related aeronautical industries).
- Managing airports in today's aviation industry with a focus on airport administration:
  - Triple bottom line management;
  - Changes in strategic and business planning, incorporating best practices and relevant international examples;
  - Integrating IT planning from the IT backbone that supports the administrative and operational functions of the organization to business models for providing services to meet customer needs;
  - Best practices of innovative asset management;
  - Commercial business practices that offer potential for diversifying airports' revenue base and changing management practice;
  - Communicating with local stakeholders about the realistic viability of airports, their air service potential, and roles within the aviation system;
  - Serving the customer amid enhanced service expectations on airports, changes in technology, and a customer-centric culture;
  - New models for training of airport staff; and
  - Generational changes and the urgent need for succession planning.

New Models of Airport and Aviation Industry Engagement

Diverse goals and challenges permeate all segments of the aviation industry. Airports and their users must find new, cooperative working models to meet these goals and challenges facing aviation. Too often, the absence of industry-level and airport-level engagement or, in some cases, outright conflict, has impeded the development of solutions that would work to the betterment of all. Participants in the ACRP strategic assessment agreed it was time to consider new models of cooperation, particularly where goals are congruent.

Given this challenge, strategic priorities for research address the following areas:

- Increasing aviation stakeholder cooperation to gravitate to a performance culture (i.e., "We are all in this together."):
  - Understanding airlines' goals;
  - Understanding what passengers want from airports and airlines;
  - Understanding what general aviation users need;
  - Communicating and cooperating among all parties to meet all goals; and
  - Best practices in the global aviation industry for airport-airline engagement.
- Air service:
  - What do airlines want from airports to add or maintain air services, including the impact of costs and the provision of reliable and cost-competitive fuel;
  - At a time when many airports are losing air service, identifying strategies that are available to maintain current air service;
  - Viability of air service incentives, fee waivers, and other possible models of adding air services; and
  - Lessons learned from past incentive programs.
- The changing airline business model and the impact on airports:
  - Understanding today's airlines and how they perceive and staff for airports;
  - Ultra-low-cost carriers, their needs, and what U.S. airports can learn from Europe;
  - Airline consortia and the implications for airports;
  - New models for incorporating performance criteria for airline service levels in airport use and lease agreements; and
  - Changes in general aviation users and how airports should respond.
- The environment and the community:
  - Working together to reduce the environmental footprint of airports and airlines;
  - Models of communicating to the community about environmental impacts; and
  - Technology demonstration and airports.

Airports in the Transportation System and the Customer Experience

Mode-based transportation planning, funding, and solution design too often fail to fully anticipate the needs of transportation users, who must negotiate the lack of connectivity. With today's increasing focus on making existing infrastructure more efficient, airports must consider their place in the larger transportation system, including the customer's

door-to-door perspective—getting from point A to point B.

Given this challenge, strategic priorities for research address the following areas:

- Airport planning and intermodal movement of passengers and goods (both on- and off-airport):
  - Barriers to funding intermodal facilities and "one-seat" rides;
  - Demand modeling and aligning airport and surface transportation planning; and
  - The role of rail (including high speed) as a possible replacement for short-haul aviation, especially in congested metropolitan areas.
- Passenger experience at the airport:
  - Communications between service providers and customers;
  - Revenue generation;
  - Standard versus ultra-low-cost facilities; and
  - New technologies and tailored marketing.
- Airport management and creating a customer-centric culture:
  - Best practices in surveying entire door-to-door experiences of airport customers; and
  - Performance criteria and scorecards for tenants and public service providers (e.g., TSA, CBP).

The Future of Airports

Given the capital-intensive nature of airports, it is very difficult for airports to plan and prepare with adequate flexibility to adapt to the quickly changing environment of today's aviation industry. Unreliable forecasts, globalization, and changing airline alliances reshuffle air service patterns; airport modernization, including NextGen, promises to remake many long-held assumptions about airports; and traditional funding sources appear to be drying up. Given this grand challenge, research might look at the impact of globalization on U.S. airports and examine what opportunities and threats exist and how they may affect our assumptions about the role of airports. A look at best practices of non-U.S. airports also could present valuable lessons from abroad.

Given this challenge, strategic priorities for research address the following areas:

- The impact of globalization on U.S. airports:
  - Opportunities and threats to U.S. airports and the effects on our assumptions about the role of airports and funding models;
  - Fuel costs and associated impacts on service;
  - Language and cultural challenges/unique customer needs; and
  - Best practices of non-U.S. airports and what U.S. airports can learn.
- The new airport professional:
  - The skills and training necessary for the next generation of airport leaders; and
  - Attracting new leaders and staff to tomorrow's industry.
- The business model of U.S. airports:
  - Assumption of responsibility for traditional airline (e.g., ground handling) and government functions (e.g., paying for facility modifications and mandated security staffing);
  - Public, commercial (i.e., similar to Canadian model), and private ownership alternatives for U.S. airports; and
  - Funding infrastructure for U.S. airports—lessons from abroad and other industries.

NextGen and Airports

With all of its promise, the implementation of NextGen will change many facets of today's aviation industry, including airports and airport planning. Airports already are affected by the incremental roll-out of certain building blocks of NextGen, and given planning horizons, airport management will need to prepare for near-term and long-term eventualities.

Given this challenge, strategic priorities for research address the following areas:

- How airports should be preparing for NextGen:
  - Understanding the variety of projects being tested around the nation that potentially will impact airports;
  - Planning, including the airport layout (or footprint) and terminal needs; and
  - Engaging the community on understanding airports' roles in NextGen, including impacts on emissions and noise contours.
- Industry collaboration and NextGen:
  - Governance models that encourage dissemination and sharing of priority setting for implementing NextGen;
  - Business models guiding implementation and use, such as models for working with the FAA and air carriers (e.g., regarding surface movements and capacity) that use a

system perspective rather than a program management focus;
    - Communicating benefits (e.g., benefits to the environment) to the community; and
    - Collaboration with the RTCA on NextGen and SMS.
- General aviation and NextGen:
    - Burden of equipage and effects this will have on the potential for airport benefits to be realized.
- Data:
    - Implications of digital communications for the airport role in the industry; and
    - Interface with other airport IT strategies.

NEXTGEN WORKING GROUP

The fifth hot topic (challenge), NextGen and airports, was selected for use by the AOC in January 2013. A follow-up workshop was held February 22, 2013. This workshop was attended by representatives from FAA, industry associations, and several participants from the November workshop. The February workshop participants developed five problem statements related to this grand challenge. On behalf of all the participants, the research team then submitted five problem statements to ACRP for consideration at the July 2013 AOC project selection meeting. The next sections describe the five problem statements as presented at the meeting. All five problem statements were authorized and funded by the AOC for the ACRP 2014 fiscal year research program.

NextGen—A Primer (ACRP Project 01-27)

The Next Generation Air Transportation System (NextGen) is a pervasive and critical component of the future of the NAS. Because of its technical nature, however, and the fact that much of the published material about NextGen is geared to industry experts and not to airport leadership and stakeholders, little is known about NextGen and how it would change aviation outside the FAA.

The objective of this research is to generate a document that presents the basic elements of NextGen, in terms and context that are relevant, familiar, and understandable to airport operators. This primer would include how existing FAA plans could potentially affect airports of all sizes and roles, the larger aviation industry, and the public. A timeline would be included that would highlight the FAA's planned roll-out of near and medium-term elements, and the long-range vision. A description of major components and a glossary of terms would also be provided to airport practitioners.

Three components of this research are envisioned: First, a "NextGen and Airports" general educational report suitable for community members, local leaders, and the public designed to raise awareness of NextGen and the role of airports. This component would focus on community impacts and how the roles of airports and other stakeholders may change as a function of changing economic conditions, changing airline industry characteristics, changing airport infrastructure, and other factors. A glossary of terms and frequently asked questions about NextGen would be included. Second, a "NextGen Resource Guide" that would provide a comprehensive list of NextGen technologies and initiatives categorized and described for airport practitioners. The audience for this document would be airport staff with a working knowledge of airports. Third, a "NextGen and Airports" overview guide targeting airport decision makers that would provide a high-level description of the NextGen initiative, including the benefits and costs to the airport and its various stakeholders. This document would be formulated to convey relevant information and technical guidance of importance to airports. It would also include planning guidance for airport directors, department heads, board members, and other senior policy interests within the airport organization.

NextGen—Guidance for Engaging the Airport Community (ACRP Project 01-28)

Communities are often brought into the planning process for airspace changes (e.g., related to NextGen) near the end of the process, when decisions have already tentatively been made. This engenders a narrow focus on the environmental issues of noise and emissions and misses the opportunity to engage and inform the overall community of the safety, capacity, and economic impact that such procedures offer. What is increasingly needed is a more inclu-

sive approach that looks at the benefits of NextGen to the entire community and the goals it has for the airport. Therefore, efforts to adopt new airspace arrival and departure procedures at airports require new methods to engage surrounding communities successfully.

The objective of this research is to develop a new and expanded model for engaging communities in airspace procedure development efforts (including planning, environmental, review, and design). This new and expanded approach would enable airports and the FAA to proactively inform the community about the benefits and costs of potential procedural changes as well as to take into account community opinions, which can be considered in making refinements to final procedure design. Such an approach would also consider the important balance between enhanced community engagement and efficient airspace procedures development (including managing procedure development schedule and costs) in order to expedite implementation of NextGen benefits. This report would provide an approach for community engagement that calls on lessons learned from airports that have successfully navigated the process of changing arrival and departure procedures. Research should include an examination of the process for engaging airports and their communities on new arrival and departure procedures, including statutory, regulatory, and policy requirements. To develop a new and expanded model for community engagement, the research would require the completion of several case studies, where the airport's engagement with the community would be summarized in order to provide information on the practices that worked effectively and those that did not. The case studies would require consultation with the FAA, airport management, airline representatives, and, where appropriate, members of the community. The research would also require an analysis of how the community engagement process changed, if at all, the design of the arrival and departure procedures.

NextGen—Airport Planning (ACRP Project 03-33)

Because many airports have the perception that NextGen is far off in the future, airport planners may neglect or put on hold future NextGen-related projects that offer potential benefits (e.g., improved safety, efficiency, and environmental performance). Research is needed to identify practical strategies for identifying airport-relevant NextGen elements and incorporating them into new or ongoing airport operations, planning, and environmental initiatives. As such, dependencies between airport operations and infrastructure and various NextGen technologies and procedures would be evaluated from the perspective of integrating both into airport development plans.

The objective of this research is to identify potential risks and uncertainties, roles and responsibilities, and other factors so that technological capability and stakeholder implementation (i.e., innovative technology, aircraft operator plans for avionics equipage, delays with deployment, etc.) can be accounted for in airport development. The research would discuss how NextGen technologies and procedures might lead to better design so as to improve safety, efficiency, and environmental performance, and reduce long-term cost. The target audience for this research would be airport planning directors and it would focus on near- to medium-term initiatives (i.e., expected implementation in the NAS within the next 10 years). In addition, potential long-term future concepts would be identified, along with corresponding implementation uncertainties and risks.

The research could include several components: (1) a baseline of near-, medium-, and long-term planning needs for airports; (2) thorough background research into the various sources of information on NextGen, including the FAA, the Joint Program and Development Office, and industry trade associations (e.g., Air Traffic Control Association and Airports Council International-North America), and FAA published documents such as Appendix B of the NextGen Implementation Plan; (3) an identification of appropriate FAA and industry contacts to ensure the research has produced a comprehensive inventory of airport planning needs and elements of NextGen that would be important over the next 10 years and beyond; and (4) a vetting workshop in cooperation with FAA and industry representatives at an appropriate industry forum.

NextGen—Understanding Optimal-Efficient Procedure Changes for Aircraft and Airspace (ACRP Project 03-34)

Design and implementation of Performance Based Navigation (PBN) is the near-term element of NextGen with significance for airports of all sizes

and missions. Development of PBN procedures is currently underway, or will be underway shortly, in a number of communities, especially at those airports and metropolitan areas identified in the FAA's Optimization of the Airspace and Procedures in the Metroplex (OAPM) program. Involvement by airports in PBN implementation is essential for success; potential opportunities exist for benefits to over-flight patterns as well as improvements to safety, reliability, and efficiencies of air services to the community. With their participation, airport operators need to have an understanding of the FAA design and implementation process and have the means to monitor metrics of the benefits and usage of these procedures to report back to their communities. Research is needed to provide an overview of existing PBN developments and future capabilities and detail how these near-term improvements would increase the efficiency of operations, including fuel savings, more direct aircraft routings, potentially decoupled airspace at closely spaced airports (increasing airspace capacity), improved airfield efficiency and safety, and other possible benefits.

The objective of this research is to describe how airports can engage with the FAA, their aircraft users, and their surrounding communities on PBN deployment, including the airport's role in the study and design phases of OAPM initiatives. Research could also provide suggested guidance on measures and metrics to allow airport operators to assess success factors regarding effects (both positive and negative) on their communities.

The research could encompass several components: (1) background research into PBN procedures and implementation, including the OAPM program as well as the potential benefits to other airports and communities; (2) a survey of existing research and FAA information about the safety, capacity, environmental, and cost-saving benefits provided by PBN developments both currently and projected for the future; and (3) case studies of PBN implementation to document best practices of FAA, airline, and airport collaboration and to determine, where possible, if the potential benefits of PBN procedures are being realized.

NextGen—Information Sharing and GIS Workshop (ACRP Project 09-12)

The amount of data generated by airports, airline/aircraft operators, and the FAA is becoming both immense and of high quality. This information can provide all of these parties a number of safety, efficiency, and decision-making benefits. In particular, geographic information systems (GIS) data, a key element of FAA's NextGen program, is becoming a required element for airport inclusion in the FAA Airports GIS database. In addition, the NavLean program would enhance geospatial data collected for all airports by 2015 (the effort may be called Airports GIS and Survey 2.0). Airports leverage the GIS data collected to support a number of applications and tools, including facility management and maintenance, Part 139 airfield inspections and compliance, safety risk management, property management, and airspace obstruction analysis. Beyond GIS, the information contained in a number of other databases generated by FAA, airlines/aircraft operators, and airports could potentially be leveraged to better decision making, increase efficiencies, and improve the balancing of risks and benefits. Lastly, to capture these benefits, issues of data security and proprietary use must be resolved.

The objective of this project is to develop guidance and evaluate practices for airports in using GIS and Survey 2.0 data by conducting a workshop with all the relevant stakeholders to simultaneously collect and disseminate such practices to practitioners.

RECOMMENDATIONS AND NEXT STEPS

The immediate practical results of ACRP Project 11-07 are the problem statements that were received directly from participants in the workshop and the focus group teleconferences. The February 2013 workshop also yielded a handful of problem statements targeting NextGen and airports. Additional problem statements will likely to be submitted from industry stakeholders who use the new guidance or who are inspired by other ACRP industry engagement.

Of utility in the longer term, this project has assisted in the refinement of outreach practices and clarification to guidance, including development of a PowerPoint presentation and educational video that will be used for several years. Lessons learned from this project will guide future problem statement solicitations and help ensure that ACRP can continue to attract quality research ideas.

The initial inventory of ACRP research, a forthcoming continuation of the research inventory, and a subsequent analysis of gaps in industry knowledge and practice offer a promise of potential utility to inform the AOC and the ACRP on topics that are most needed by the airport industry. As an initial effort, ACRP Project 11-07 was intended to prove the concept and test the process for a more complete analysis of ACRP research results and industry research needs. The complete ACRP research results inventory, reflecting analysis of the remaining ACRP research fields and their respective sub-topics, will begin in 2014 and will be published thereafter.

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