# Final Technical Report

# Center of Excellence for Technical Training and Human Performance

# Project CA-012 Technical Operations: Airway Transportation Systems Specialist Training Analysis

**Description:**

The Airway Transportation Systems Specialist (ATSS) is a highly technical function with a wide range of potential duties. After initial training, the ATSS may not perform a specific task for years then be called upon to do so in a challenging environment.

Phase I of this project is designed to review the initial and recurrent training processes and perform a gap analysis between that training and the needs of the ATSS in the field.

**Background**

Airway Transportation Systems Specialists (ATSS) perform in the capacity of highly specialized electronics technicians. ATSS personnel install, evaluate, maintain, modify and certify facilities, systems, services and equipment such as ground based navaids (VOR, ILS, LPDME, and lighting) that support the National Airspace System (NAS). This involves working with surveillance radar, weather, communications, automation, and navigational aid equipment as well as various environmental support facilities and equipment.

This work also includes periodic maintenance, modification, troubleshooting, repair and replacement of malfunctioning equipment, and certification. ATSSs may be required to maintain entire facilities, subsystems, or individual services or equipment that is often located in remote areas, where they have minimal resources and may be required to work independently remotely and report to a supervisor.

The ATSS work environment and job duties present special challenges. Several critical factors affecting demand for systems specialists result not only from the unusual requirements of this particular job series but also from the demands placed on incumbents in the job by the external aviation environment.

ATSS support NAS components widely scattered throughout their geographic areas of responsibility. The NAS itself is divided into three major geographic service areas- for the purpose of equipment maintenance: Eastern, Central, and Western. The ATSS is challenged with working in remote areas such as: Deadhorse, Dutch Harbor, Adak, Cold Bay, and Barrow Alaska in addition to mountainous regions such as Jackson Hole, WY and islands with limited resources such as Roto, Tinian, Saipan, CNMI and Lihue, Molokai, and Lanai in Hawaii.

In addition to working in remote areas they are tasked to install, evaluate, maintain, modify ever-changing systems. They have very little time to 'get up speed' on the fast-changing technologies and at the same time must be able to recall training on systems which they may have never maintained or it may have been a long time since they had experience with a system, which can be challenging and problematic from a training perspective.

**Problems Identified**

1. Old generation systems often have old manuals which are scanned for tablet use which do not provide a searchable easily accessible information tool to work efficiently in the field.
2. Rapidly changing technology with a blend of legacy and new generation equipment.
3. Difficulty to recall and retain training on systems after long periods.
4. May not have had any operation experience or opportunity to practice specific tasks or procedures.
5. Differences in educational background and generational learning styles of ATSS new hires.

This project aligns with the AJI-2 Phase 2 (Strengthen the Organization and Transition to Enhanced Training Methods) by better understanding needs of the Technical Operations group and the ATSS in the field, especially for initial, recurrent, and on-demand training.

**Investigation Team**

**University Team:**

Western Michigan University (Lead)

Purdue University

**FAA Sponsor:**

Air Traffic Organization - Safety and Technical Training

AJI-2300 Training Policy & Programs

**FAA Technical Monitor:**

Mr. Robert Collins

**Methodology**

Phase I work studied how initial ATSS training is performed, what recurrent training is available, and what technical information is available to assist in performing work. ATSS personnel were queried on the effectiveness of training and information and what additional training and material would be beneficial. Information was gathered, summarized, and a gap analysis performed assessing ATSS needs and formed the basis for further study.

**Project Goals & Objectives:**

1. Perform a literature review of current FAA ATO Technical Operations training, recurrent training and availability of on-demand training.
2. Collect data from technical management and technicians on what they need to further support their work and increase effectiveness and efficiency.
3. Perform a gap analysis to determine needs and priority.

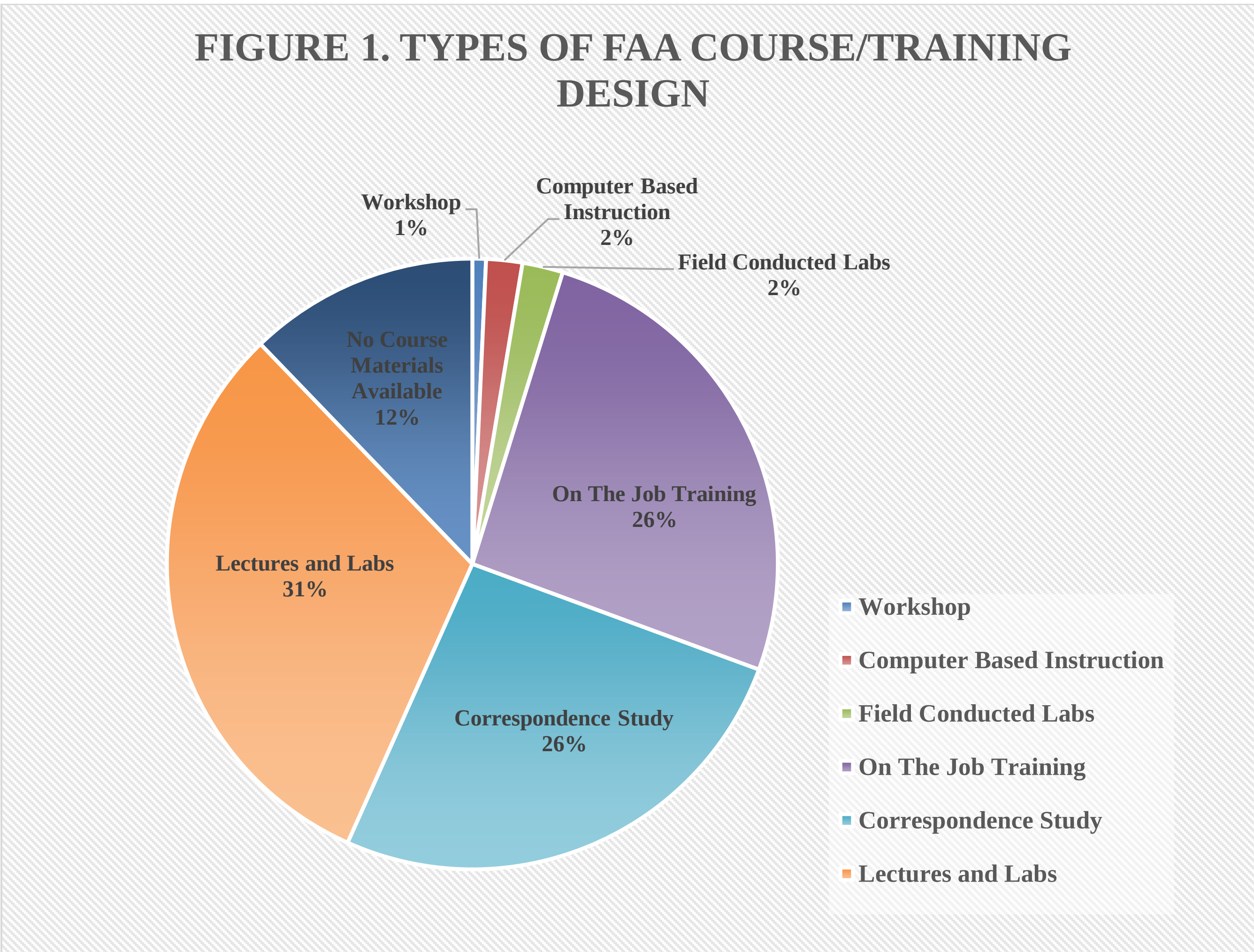
**Project Deliverables:**

A. Summary of literature review findings.
B. ATSS employee input summation.
C. Gap Analysis results.
D. Recommendations for next steps.

**Findings**

*Goal 1: Perform a literature review of current FAA ATO Technical Operations training, recurrent training and availability of on-demand training.*

A review of descriptive course information related to Technical Operations provided to the COE-TTHP was performed. Figure 1 breaks the course information down into instructional categories. Traditional lecture and lab instruction represents 31% of the courses, with correspondence study and on-the-job training (OJT) each representing 26%. As noted in Figure 2, the majority of laboratory and hands-on training takes place in the traditional lecture/lab courses. On-the-job training contained relatively few formal laboratory and hands-on training activities.



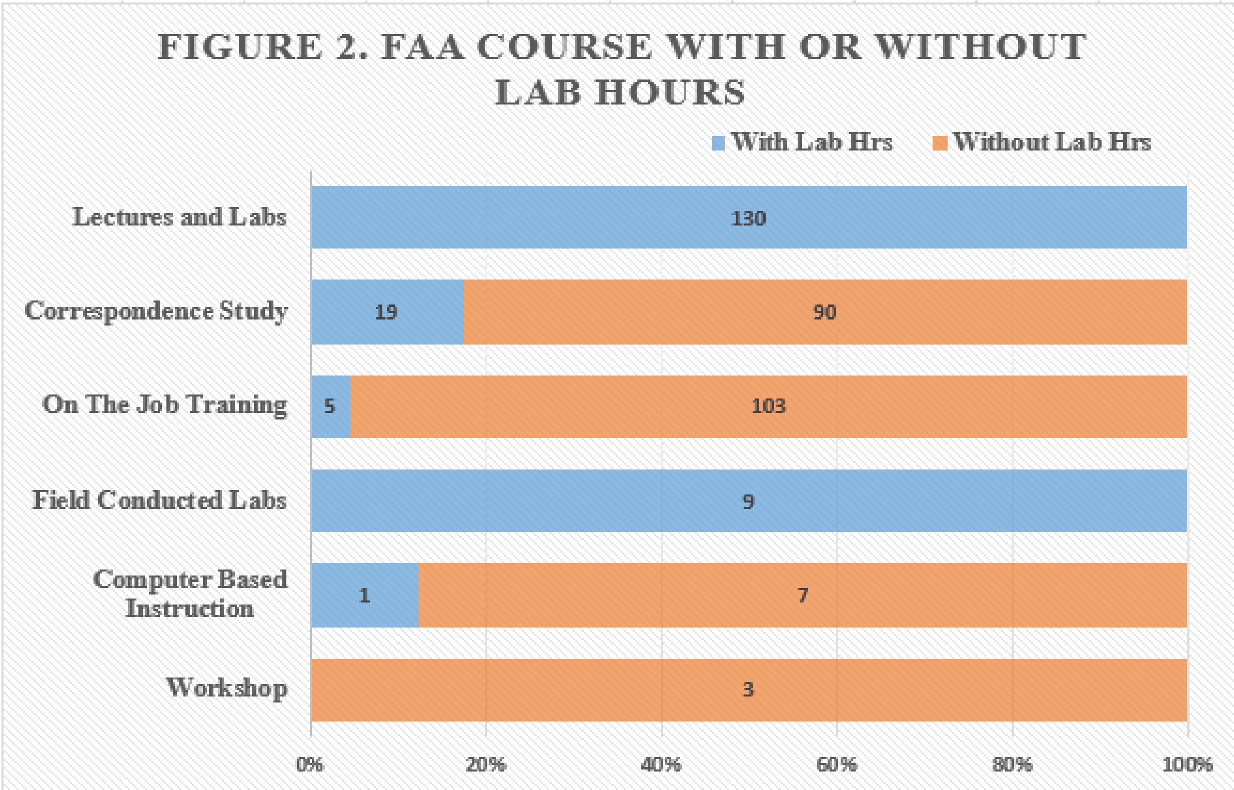
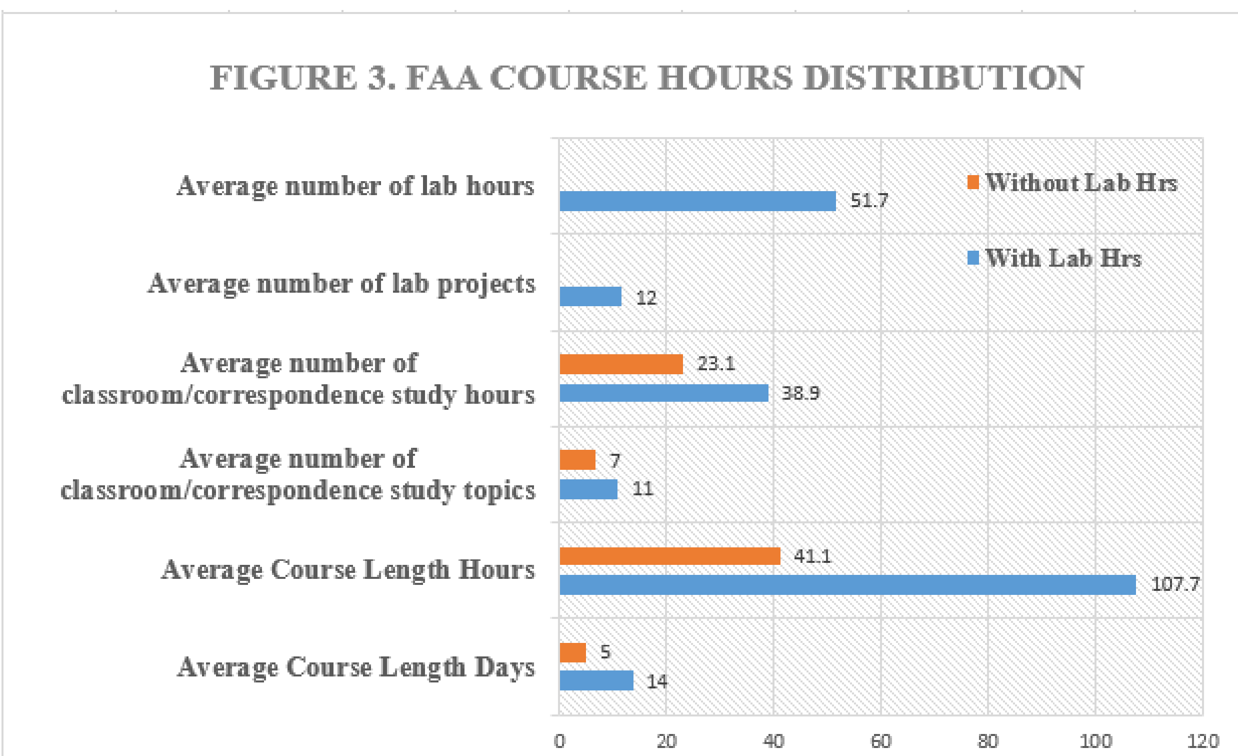



Figure 3 displays average hours and projects for the courses.



None of the courses examined were available ‘on-demand’. During the visit to KIND, the team was made aware of a set of short videos on various ATSS equipment and procedural topics. The system indicated 84 videos currently available, all of which were approved by J8. The ATSS tower and TRACON manager stated many more were available but a search only displayed 84.

*Goal 2: Collect data from technical management and technicians on what they need to further support their work and increase effectiveness and efficiency.*

A visit to the facilities in Indianapolis Indiana took place March 27 – 29, 2018. The team visited the Enroute Air Traffic Center, KIND TRACON, and KIND tower. Equipment stations in area and on the airfield were visited including long and short range radar, weather radar, transmitter sites, and airport lighting and nav aids. Managers and technicians discussed and demonstrated how the facilities and equipment worked, training received and technical support available to them.

<u>KIND Site Visit Assessment</u>

To assist in categorizing key components of the ATSS operation observed at KIND, the research team used a 5-P categorization model. This model is a categorization of key operational components comprising: People, Parts, Process, Procedures and Placement. This categorization model is suitable for aviation, aerospace and other technology-based operations and is useful for helping clarify observational research as well as quality and safety improvement initiatives.

Similar 5P assessment and project planning models are common in organizations performing continuous process improvement and in-service quality models for Quality Management Systems (QMS) (TICSI, 2018) and in Safety Management Systems (SMS) components which are part of a systematic regulatory requirement of daily tasks (U.S.D.O.T. -FAA, 2012). The 5P assessment methodology has been validated in related Six Sigma applications in manufacturing (Priyo, 2012), aeronautical and piloting risk management tools (UND Aerospace, 2007) and within the medical industry (Huber, 2006). It has been found to be helpful as an enabler of further discussion and evaluation topic areas for process optimization, quality and safety improvement initiatives in high consequence operations.

<u>People</u>

*Technicians are stretched for capabilities and skills*. Managers relayed that cultivating a technical workforce with requisite technical capabilities to maintain Dashboard metrics can take between three and ten years to fully develop. This is compounded by a reduced “leaner” available workforce which was consistently stated as a contributor and concern by managers regarding skills loss and retention.

The research team noticed very similar characteristics and competencies among the technicians we followed at KIND, to those of high performing air vehicle maintenance technicians in industry. They were noted for their quiet demeanor and had a working knowledge of the major equipment within their domain. This is an interesting characteristic in that the responsible Technician at remote stations also “owns” everything about the station: grounds keeping, Air conditioning/chillers/back-up generators (support and knowledge of these is a big factor in computer, physical equipment) in addition to more advanced technical components of the computer, radar or ATC components themselves.

Technicians related that from experience, they ‘know what works’ as far as resourcing, procedures are concerned, but sometimes are forced to adjust to new procedures or staffing requirements that may not have been reviewed for their full impact at the front line. While it was acknowledged that certain change is inevitable within such a dynamic operation, technicians related having to ‘bend with the new rules’ - and they will – but related knowing that ‘this new policy or procedure probably isn’t going to work as designed’…or ‘this could work if they’d look ahead and ask us how to implement <a change> better”.

The research team believes this highlights a need for Technicians to better visualize how and where they fit within the larger NAS and the local system.

Multiple disciplines and skill sets from skilled trades and industries (for example, working knowledge of HVAC systems was consistently mentioned by technicians) are utilized and highly valuable in addition to core technical competencies related to ATC related equipment. Technicians related technical experience from a variety of previous jobs outside of current ATSS which they called upon. While this is a positive in many circumstances, the research team wonders if this could also contribute to non-standard approaches to troubleshooting, and if this dynamic should be further evaluated and reflected in the offerings of current training. Related to above, a mentoring program might be considered where new technicians job shadow a similar facility technician before release.

Parts

It is noteworthy that the responsible technician in more remote stations "owns" everything about the station, including: grounds keeping, air conditioning/chillers/back-up generators. Support and knowledge of these in particular plays a big factor in maintenance and operational reliability of mission-critical ATC computer equipment. Additionally, technicians must also possess operational knowledge of those same advanced computer, radar or ATC components themselves.

For example, there was a blend of older/legacy and newer technologies being used at KIND which was observed to drive a variety of approaches to troubleshooting (some older equipment requires hands-on, while newer more integrated equipment is treated more as a remove and replace 'black box'). Discussing with technicians and supervisors, this plays a role in applicability and knowledge retention of initial, OJT, and academy-based training.

Process

*Dashboard Performance Metrics*. Type and age of equipment was reported as not always considered in Dashboard metrics. While dashboard metrics are a necessary visual metric of operational performance, they sometimes feel in conflict to managers versus quality of the fix. In other words, type and age of equipment (impacting time on task and time-to-resolution metrics) are not always considered in current Dashboard metrics. Therefore, a perception of emphasis is sometimes on "getting out of red and into green" over a sustainable (quality) fix.

*System visibility and Impact Awareness*. There was emphasis on the technician visualizing and maintaining awareness, process and ramifications for requesting, taking out and restoring key equipment to work on. Work must be coordinated and impact of taking a system down understood as well as each stakeholder having different needs and priorities.

Procedures

Most procedures observed at KIND were paper based but readily accessible in binders, although locating specific instructions could take several minutes if a technician had to identify a specific procedure or reference. While an experienced technician relies less on discrete task help, assistive data, regulatory data entry requirements or general system visualization can be hampered by the paper-based format. This has implications on newer technician performance, and there is a need to further explore how to optimize a blend of paper and digital access to technical data, which could help improve performance metrics.

Placement

*Service Coverage Geography.* Technicians are sometimes task loaded and hampered by add-on trouble tickets. Additional sites/discrepancies get added while enroute to the original call. This requires obtaining additional equipment; also, appropriate vehicle may not always be available. Given geographical size of coverage area this can be a problem.

*Goal 3: Perform a gap analysis to determine needs and priority.*

Discussion and Conclusions

A recurring theme during the KIND visit was that of "impact" that equipment and system repair, servicing, or change has on the NAS. The need to have all systems operating makes it difficult for technicians to spend time learning and training new technicians in detail.

We noted several specific observations during the KIND visit:

- The large variety of legacy and newer technologies being used appears to drive varying approaches to troubleshooting. This has major implications for initial, OJT, and academy-based training and standardization.

- Based on what skills a new ATSS brings to the job it takes between 3 – 10 years to fully develop them.

- The number of ATSS personnel is less than deemed necessary by managers.

- Field service dispatch/enroute: sometimes hampered by add-on trouble tickets. The technician may be assigned additional sites/discrepancies enroute to the initial trouble call location, driving a need to obtain additional equipment. Also, the appropriate vehicle may not always be available. Given geographical size of coverage area this presents a resource and time to arrival problem.

- Responsible technician at remote stations "owns" everything about the station: grounds keeping, Air conditioning/chillers/back-up generators. Support and knowledge of these is a big factor in computer, physical equipment in addition to more advanced technical components of the computer, radar or ATC components themselves.

- Multiple disciplines and skill sets from other industries (especially HVAC which was consistently mentioned!) are utilized and highly valuable in addition to core technical competencies related to ATC TechOps equipment. Question: Could this drive different non-standard approaches to troubleshooting? Should this be reflected in the offerings of current training?

    - Related to above: is there a mentoring program or should one be considered where new techs. Job shadow a similar facility tech. before release?

- Emphasis on knowing ramifications and process for requesting, taking out and restoring key equipment to work on. Even minor repair and/or validation tests back into service require a carefully coordinated process with each stakeholder having differing needs and priorities.

- We noticed an extremely similar personality trait among the technicians we followed at KIND, to that of high performing air vehicle maintenance technicians in industry: quiet, very methodical and knowledgeable, know what works but often asked to 'bend with the new rules' - and they will – but they know that ‘this isn’t going to work’…or ‘this could work if they’d look ahead and ask us how to implement it better <a change>….” The team believes this highlights a need for Technicians to better visualize how and where they fit within the larger NAS and the local system.

**Potential Future Research**

Based on the findings, we suggest that phase II research would perform

1. Survey the ATSS population to collect data on what technical tasks they find most difficult from the perspective of available information and technical support.
2. Analyze the results to rank order the tasks.
3. Using a focus group, identify the specific issues and needs for the most highly identified tasks.
4. Develop additional technical content and/or methods of access to the content and field test. Example: Integrate interactive 3D modeling and the current (84 plus) short videos on various ATSS equipment and procedural topics (approved by J8), into an augmented reality app for phone and tablets which could be used in the field without the need for internet to recall and refresh information when needed. This method has recently been successful for the FAA PEGASAS Weather Technology (WTIC) Center of Excellence.

Potential Funding

The Western Michigan University CA012 Technical Operations – Airway Transportation Systems Specialist Training Analysis has a remaining balance of $6,668 which could be applied to phase II.

The Purdue University CA012 Technical Operations – Airway Transportation Systems Specialist Training Analysis has a remaining balance of $X,XXX which could be applied to phase II.

The Western Michigan University CA010 Modular Curriculum Design has a remaining balance of $35,269 which potentially could be used based on whether this project seeks to submit a phase II project.

**Acknowledgements**

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