IAEME

IJAM

INTERNATIONAL JOURNAL OF AVIATION MANAGEMENT

Publishing Refereed Research Article, Survey Articles and Technical Notes.

Journal ID: 2988-77C5

IAEME Publication
Chennai, India
editor@iaeme.com/ iaemedu@gmail.com

https://iaeme.com/Home/journal/IJAM

International Journal of Aviation Management (IJAM)
Volume 2, Issue 2, July-December 2024, pp. 1-42. Article ID: IJAM_02_02_001
Available online at https://iaeme.com/Home/issue/IJAM?Volume=2&Issue=2
Journal ID: 2988-77C5, DOI: https://doi.org/10.34218/IJAM_02_02_001

CLOSING THE SAFETY GAP: A FRAMEWORK FOR AVIATION MAINTENANCE ORGANIZATIONS

[1.] Ayegba David Haruna, [2.] Olugbenga Olayinka Taiwo, [3.] Ridwan Adebowale Yusuf

[1.] Department of Industrial and Manufacturing Systems Engineering, University of Michigan Dearborn, Michigan, USA.
ORCID: 0009-0005-3737-5572

[2.] Department of Occupational Safety and Health, Murray state University Kentucky, USA.
ORCID: 0009-0008-4102-0338

[3.] Department of Project Management, Royal Melbourne Institute of Technology Melbourne, Australia.
ORCID: 0009-0008-3329-0223

[1.] Corresponding Author: Ayegba David Haruna

ABSTRACT

Limited resources and tailored advice frequently make it difficult for small U.S. aviation maintenance companies to adopt formal Safety Management Systems (SMS). This paper offers a scalable SMS framework meant for Part 145 maintenance companies with under 50 employees. Examining 4–6 small repair stations via document analysis, safety performance data, and incident records, a multi-case qualitative method was used. Common obstacles the study found hindering SMS adoption in small businesses were financial limitations, regulatory complexity, technical constraints, and cultural issues. Important topics are disparities in hazard reporting, dependence on informal safety practices, and insufficient safety-focused staff members. Building on

these results and drawing from systems theory and change management concepts, the paper offers a four-tier SMS model (Leadership Commitment; Simplified Reporting & Documentation; Integrated Safety Training; Progressive Safety Performance Monitoring) that scales to an organization's size and maturity. Guiding small maintenance providers through incremental SMS implementation, a phased road map from initial start-up to full institutionalization is suggested. Expert Delphi review and a pilot implementation confirmed the framework, which showed better safety communication and proactive risk management. This scalable SMS system allows even the smallest maintenance companies to develop a positive safety culture and methodically control risk, so addressing the gap between large and small businesses.

Keywords: Safety management system, Small organizations, Scalability, Aviation maintenance, Safety culture, Framework

Cite this Article: Ayegba David Haruna, Olugbenga Olayinka Taiwo, Ridwan Adebowale Yusuf. (2024). Closing the Safety Gap: A Framework for Aviation Maintenance Organizations. *International Journal of Aviation Management (IJAM)*, 2(2), 1-42.

https://iaeme.com/MasterAdmin/Journal_uploads/IJAM/VOLUME_2_ISSUE_2/IJAM_02_02_001.pdf

I. Introduction

Over the last ten years, aviation safety has been given worldwide priority by the introduction of formal Safety Management Systems (SMS). Aviation service providers—including airlines, maintenance companies, and others—are required by the International Civil Aviation Organization (ICAO) to implement SMS as part of its Standards and Recommended Practices (SARPs) compiled in ICAO Annex 19. These SARPs specify SMS in terms of four main elements: Safety Policy and Objectives, Safety Risk Management, Safety Assurance, and Safety Promotion. To satisfy these worldwide criteria, major maintenance, repair, and overhaul (MRO) companies and large air carriers have progressively created mature SMS programs. The Federal Aviation Administration (FAA) in the United States codified SMS criteria in 14 CFR Part 5 for particular certificate holders—initially Part 121 air carriers—and provided advice including Advisory Circular (AC) 120-92 to help with implementation. Emphasizing a methodical, top-down approach to controlling safety risk and fostering a positive safety culture, the FAA's framework reflects ICAO's.

SMS adoption and sophistication, though, show a notable difference between large and small companies. While small aviation maintenance companies—e.g., independent Part 145 repair stations with a few dozen employees—often lack the resources and direction to implement SMS completely, major airlines and large MROs usually have whole safety departments and strong data-driven risk management systems. Though a recent Notice of Proposed Rulemaking indicated SMS requirements for Part 135 and Part 145 operators, the U.S. FAA has not yet required SMS for Part 145 maintenance certificate holders as it has for airlines. For small maintenance providers, compliance is mostly voluntary in the interim. Many others lack official SMS, which creates a safety gap between larger and smaller organisations; some participate in FAA's voluntary SMS program, particularly those looking for foreign approvals.

Feedback from industry highlights the difficulties small operators encounter. Critics of the FAA's SMS rulemaking contended that the one-size-fits-all Part 5 rules were "designed for large air carriers, not for smaller operators" and are too prescriptive considering the size and variety of small businesses. They begged the FAA to create easy SMS criteria really scalable to companies with constrained resources. The National Air Transportation Association (NATA) underlined, too, that SMS solutions shouldn't be too expensive or too onerous to cause companies to shut down. It also mentioned a dearth of pilot programs proving SMS advantages for small operators. These issues highlight a clear question: How can we close the safety gap by modifying SMS frameworks to be practical and efficient for small aviation maintenance companies?

This paper answers that question by creating a framework for scalable SMS implementation specifically for small U.S. aviation maintenance businesses. The goals of the study are to: (1) identify the particular obstacles and requirements of small maintenance companies in implementing SMS; (2) derive best practices and critical elements of a right-sized SMS from literature and field data; (3) propose a structured yet flexible SMS framework (with core components and a phased implementation roadmap) suitable for organizations with <50 personnel; and (4) validate this framework through expert review and a pilot application. The aim is a feasible model allowing small maintenance providers to attain the safety advantages of SMS—such as proactive hazard identification, risk reduction, and continuous improvement—without excessive load.

This article is structured as follows. Examining past SMS in aviation and other high-reliability sectors, including regulatory advice (ICAO, FAA) on scalability, theoretical

frameworks (e.g., systems thinking and change management), and lessons learned from implementations in small organizations, the Literature Review Describing the multi-case study and mixed-methods approach used to collect and evaluate data from multiple small Part 145 maintenance companies, the Methodology section Key obstacles, themes, and best practices found across the cases are presented in the Findings section. Building on those insights, the Proposed Framework section describes the four-tier scalable SMS model and an accompanying scalability matrix and phased implementation roadmap (from start-up to institutionalization of SMS). Results from a short-term pilot test as well as industry experts and an FAA-industry focus group assessment of the framework are then summarized in a Validation and Expert Review section. The Discussion acknowledges constraints, considers the consequences of this work for theory and practice, and offers future research paths. At last, the Conclusion emphasizes once more the need of using scalable SMS in small aviation maintenance companies and how the suggested framework helps to close the safety gap.

II. Literature Review

Regulatory Background and SMS Frameworks

ICAO SMS Criteria: All aviation service providers under ICAO's safety management SARPs must implement an SMS suitable to the size and complexity of their operations. Annex 19 describes four basic building blocks of an SMS: Safety Policy and Objectives, Safety Risk Management (SRM), Safety Assurance, and Safety Promotion. Every component includes different elements—about 12 in all—including management commitment, hazard identification and risk assessment, safety performance monitoring, incident reporting systems, training, and safety communication. ICAO's Safety Management Manual (SMM) records these components and offers implementation direction. The key components and features of an ICAO-compliant SMS are summarized in Table 1.

Table 1: Key Components of an ICAO-Compliant SMS and Their Elements

SMS Component	Key Elements (Examples)
Safety Policy & Objectives	Management dedication (obvious safety policy, leadership responsibility); Safety responsibilities (specified roles and SMS responsible executive); Emergency response planning; SMS documentation (manual, procedures). Management of safety risks

Safety Risk Management	Identifying hazards (reporting systems for hazards, incidents); Risk assessment and control implementation (process to analyze risk).
Safety Assurance	Performance tracking and measurement (track safety indicators, audits); Change management (process to evaluate how changes affect safety); Ongoing SMS development (periodic assessment and enhancement).
Safety Promotion	Education and training—safety training for staff members at all levels; Safety communication—safety meetings, newsletters, and comments on reported problems.

Though it lets some leeway in how they are fulfilled, ICAO underlines that all the aforementioned elements apply regardless of organizational size. Appropriate to the complexity of the operation, the SMM recommends a phased implementation and scaling of SMS. A small maintenance organization, for instance, may use more basic paperwork or combine duties (one person supervising several SMS functions) provided the fundamental purpose of each component is met.

FAA Rules and Guidance: The FAA published 14 CFR Part 5 in 2015, mandating Part 121 air carriers to use SMS, and has released Advisory Circulars (AC 120-92 series) to direct SMS growth in the United States. Although Part 5 officially applies just to airlines at now, the FAA has urged other certificate holders—Part 135 charter operators, Part 145 repair shops, etc.—to voluntarily adopt SMS, emphasizing that an SMS offers a systematic way to control safety concerns for any aviation company. AC 120-92B specifically discusses scalability, claiming that the difference between a large, medium, and small organization's SMS is mostly one of size and complexity, not of kind. Regardless of size, all important SMS functions—policy, SRM, assurance, promotion—are required; Part 5 lets companies of various sizes satisfy those needs in various ways. The FAA recommends that "track and resolve safety issues" for smaller companies using current programs and easier procedures be without significant new bureaucracy. Many small U.S. maintenance companies, on the other hand, have been slow to adopt SMS absent a legal requirement. The FAA indicated in 2023 that the SMS rule would cover some others, Part 135 operators, and Part 145 repair facilities. Industry groups such as NBAA and NATA have fought for the new regulations to include scalability and flexibility for small businesses. Especially, by the end of 2025 the U.S.-EU aviation safety bilateral agreement now mandates U.S. repair stations serving European markets to have an SMS consistent with

ICAO Annex 19, therefore compelling many small U.S. repair stations to use SMS under the FAA's voluntary program. This outside pressure emphasizes the need of creating scalable SMS solutions.

Scalability Challenges for Small Organizations

Research and industry knowledge expose discrepancies in execution for small and non-complex businesses even with regulator guarantees that SMS is scalable. A common thread is that formal SMS frameworks, as first imagined, assumed a degree of organizational capacity (personnel, knowledge, data systems) more typical of large airlines or MROs. Operating on limited budgets, little staff, and casual procedures, small maintenance companies find a full-blown SMS to be overwhelming. A study by the Australian Transport Safety Bureau revealed that across high-risk sectors, smaller businesses might lack the required resources and specialist knowledge to properly implement an SMS. Many such businesses will not willingly implement a comprehensive SMS unless mandated since the perceived regulatory load is great in relation to uncertain safety advantage. In fact, those who commented on FAA rulemaking contended that Part 5 SMS standards were "too prescriptive" and not appropriate for the "variation of size and scope" in the Part 135/145 community, urging a scaled-down model for small businesses.

Guidance materials recognize these difficulties. Noting that smaller operators are more flexible and often already perform many safety practices informally, the Civil Aviation Safety Authority (CASA) of Australia released a guide for SMS in small/non-complex organizations. One safety practitioner famously called SMS "organized common sense"; while the practices could be found in a tiny business (e.g., people use common sense to remain safe), they must be structured and methodical to qualify as an SMS. According to CASA, there is no universal solution; what counts is creating an SMS that suits your company and efficiently controls its safety performance. Key recommendations are to make the SMS a "living system" integrated into daily operations rather than a manual on a shelf and to use current procedures—e.g., maintenance quality checks, on-the-job training—as part of the SMS instead of building redundant systems. Importantly, even a small business has to designate someone to promote safety (usually the responsible manager/owner) and support a Just Culture so that staff members may report risks without fear.

Still developing is empirical research particular to SMS implementation in maintenance companies. Finding that cultural resistance, misunderstanding between SMS and current quality management systems, and lack of top management commitment were major obstacles, Gerede (2015) undertook a qualitative study on barriers to SMS implementation in Turkish

maintenance organizations. Jaiswal et al. (2018) likewise polled aircraft maintenance staff members and found discrepancies in safety reporting and training frequency, therefore recommending more methodical safety education in smaller maintenance organizations. Case studies from other high-reliability industries reflect these problems: in maritime and rail, small businesses battled SMS until regulators offered customized templates and assistance (e.g. sample forms, simplified hazard logs). An OECD study on overcoming SMS implementation challenges found that in road transportation, where many businesses are quite small, SMS adoption was low without outside pressure and simple-to-use models. Management commitment and safety communication were shown in the study to be essential for success regardless of company size; smaller businesses must particularly concentrate on these "soft" issues as they lack sophisticated analytical tools.

All things considered, the research shows that although the four pillars of SMS are universally relevant, the execution has to be right-sized. In small companies, financial limitations and insufficient staff are major obstacles that can cause delays or superficial implementation. Scalable methods are required that preserve the purpose of every SMS component but lower complexity; for example, using more straightforward risk assessment strategies, merging responsibilities, and applying gradual modifications. Applying change management concepts is also vital since SMS is an organizational change process that calls for leadership buy-in, staff involvement, and gradual cultural transformation. Though relevant, models like Kotter's change steps or ADKAR have to be modified for small business settings with informal communication and flat hierarchies. At last, a systems-thinking viewpoint tells us that even a little maintenance shop is a socio-technical system where interactions among people, processes, tools, and environment produce safety. Approaches like Safety-II and resilience engineering promote knowledge of how actual work is done and how tiny teams adjust to complexity. These points of view support the idea that an SMS in a small organisation should be an improvement of the current system of work to make it more consistently safe rather than a bureaucratic overlay.

Best Practices and Case Insights

Several best practices for implementing SMS on a smaller scale emerge from the cross-industry experience and accessible case studies:

Visible Management Leadership: Small companies depend much on leaders' attitudes. A strong example is set when the owner or responsible manager actively encourages safety by, for example, personally chairing quick safety meetings or visibly addressing staff safety issues.

Management dedication has been mentioned as "the single most important factor" influencing SMS performance in any size company. Practically speaking, this means the responsible executive in a small repair station has to push SMS implementation, set aside time and money (even if limited), and authorize staff members to stop working if safety is in doubt.

Effective small-company SMS implementations build on what is already in place instead of establishing new departments or comprehensive documentation from scratch. For instance, instead of drafting completely different procedures, if a repair station has a quality control inspector and a quality manual (as mandated by law), those can be enlarged to cover safety risk management activities and an SMS manual section. The FAA points out that SMS "builds upon the processes and procedures that already exist," therefore enabling cross-functional communication and preventing redundancy. Many safety activities—toolbox talks, incident reports—might already be taking place informally; formalizing them is usually a question of documentation and habit rather than generating extra responsibilities.

A hallmark of a scalable SMS is a simple hazard reporting system available to all staff members. A one-page hazard report form and a drop-box (with the choice to submit anonymously) greatly boosted reporting in one flight school case study by reducing barriers and fear of retaliation. Basic tools like a shared notebook, whiteboard, or a straightforward online form have helped small maintenance companies to effectively record problems. Every employee must know how to report and believe that management will handle reports justly. Surveys have revealed that although many technicians could claim knowledge of reporting procedures, ongoing awareness campaigns are required to keep involvement with the reporting system.

Modular training incorporated into daily work helps small businesses more than formal multi-day training courses, which are costly and time-consuming. For example, one case included a 15-minute safety topic into weekly staff meetings, rotating through topics including human factors, appropriate documentation, and past incident case studies. Over a year, this addressed necessary SMS training in bite-sized chunks, which 90% of staff found more beneficial than an infrequent long course (as reported in internal surveys). Even in a small team, such continuous training and communication support development of a safety culture. Gaining their involvement depends on stressing "just culture" values—that honest mistakes or hazard reporting will not be punished.

Small aviation maintenance companies don't operate in isolation; many belong to industry associations or informal networks. Among colleagues, sharing safety resources and lessons learned is a best practice. For instance, member repair stations could utilize SMS implementation tools and templates created by the Aircraft Electronics Association (AEA). Some have discovered that by applying shared frameworks and even distributing a safety manager resource across two smaller businesses, they can obtain a functional SMS that would be difficult to sustain by themselves. Regulators and industry groups can help this by offering free templates, checklists, and advice aimed at small businesses, which EASA and Transport Canada have done to some degree in their areas.

Given these revelations, it is clear that small U.S. maintenance companies require an SMS system summarizing these best practices. The framework should guarantee execution simplicity and compliance with the intent of ICAO/FAA criteria. The studies suggest emphasizing basic enablers such as leadership and culture, supporting simplicity and integration, and phasing in implementation. Our study develops on these ideas by looking at actual small maintenance activities, finding what works and what doesn't, and then creating a customized framework. The following part describes the approach taken to carry out this study.

III. Methodology

Research Design

A qualitative multiple-case study design was chosen given the exploratory character of this research and its emphasis on contextual elements. This method allows for cross-case comparison of patterns and an in-depth knowledge of how small aviation maintenance companies approach (or struggle with) SMS implementation. The study was carried out in two primary phases:

Case Studies: Data Collection & Analysis We deliberately chose a sample of small Part 145 maintenance companies—repair stations—in the United States. Selection criteria included: having fewer than 50 full-time employees; varied maintenance specialties (e.g. avionics shop, engine repair, general airframe maintenance) to reflect a range of settings; and different levels of SMS adoption (from no formal SMS to partial or voluntary SMS implementation). In the end, six companies took part, with staff sizes between 12 and 48, designated Case A through F for confidentiality. Table 2 offers a summary of the profiles of the case organizations.

Table 2: Profile of Participating Small Maintenance Organizations (Cases A–F)

Case	Size (Employees)	Specialty	SMS Status (at start)	Certification
A	15	Avionics & Instruments	No formal SMS (basic QC program)	FAA Part 145, no foreign approvals
B	28	Engine overhaul (piston GA)	Basic SMS elements in place (informal)	FAA Part 145, considering SMS for FAA/EASA
C	45	Airframe maintenance (GA jets)	Formal SMS *voluntarily* implemented (2 years)	FAA Part 145, FAA SMS Voluntary Program participant
D	12	Helicopter component repair	No SMS, ad-hoc safety efforts	FAA Part 145
E	32	General maintenance (mix)	Partial SMS (pilot program)	FAA Part 145, pursuing EASA approval
F	48	Avionics (multiple locations)	Formal QMS; SMS in planning stage	FAA Part 145, ISO 9001 QMS certified

To guarantee strong results, we drew on several data sources for every case (data triangulation). The main data sources were:

Talks: Three to five people from each company, including the responsible manager or owner, a maintenance supervisor or safety officer (if one existed), and one or two technicians, participated in semi-structured interviews. Interviews concentrated on grasping present safety practices, SMS attitude, perceived obstacles, and recommendations for change. Transcribed for analysis, 25 interviews—roughly 45–60 minutes each—were conducted either in person or via teleconference.

We gathered pertinent papers including FAA inspection reports or audit results (with consent), training records, sample hazard reports or incident logs, and any current safety policies or manuals. We looked over general operating manuals and quality control procedures

in cases lacking SMS documentation to find components overlapping with SMS (e.g., internal audit checklists, SOPs possibly controlling risk).

Safety Performance Data: Where available, we collected fundamental safety performance indicators from each case—for example, the number of incidents/accidents or major findings in the last 2–3 years, number of hazard reports filed, and any safety performance metrics tracked internally. For cases lacking formal metrics, we depended on narrative accounts of safety events and their management.

Site visits to four of the companies revealed non-intrusive observations of the work environment—e.g., signage, apparent safety practices on the shop floor, informal interactions—and brief follow-up clarifications with staff members. These contextual insights deepened our knowledge of the safety culture.

Data gathering spanned roughly eight months. Though we adhered to a replication logic (Yin, 2018), treating each case study as an experiment that could validate or contrast with patterns from others, every case was handled as a bounded unit of analysis.

Data Analysis

Our results came from a mix of qualitative coding, cross-case synthesis, and analytical methods:

Thematic Coding Qualitative analysis tools were used to inductively code interview transcripts and document excerpts. Initial coding produced a list of codes connected to, for example, "management attitude," "hazard reporting," "resource constraints," "training," "culture/blame," "regulatory understanding," etc. We grouped these by means of several reviews into significant themes that reflected obstacles, enablers, or results. For example, under the theme "Reporting & Just Culture Issues," individual codes such as "fear of punishment" and "no reporting system" were combined.

SWOT Analysis (per case): We did a straightforward SWOT analysis—finding internal Strengths and Weaknesses in their present safety management approach and external Opportunities and Threats connected to SMS implementation—to organize the analysis for each organization. A strength, for instance, could be "close-knit team communicates well on concerns," a weakness "lack of formal training," an opportunity "FAA voluntary program resources available," and a threat "possible future regulation or client requirement for SMS." This emphasized the preparedness and particular background of every situation.

Noting recurring patterns, we compared cases on important dimensions—e.g., presence of a safety focal point, number of safety meetings held, incident rate, etc. using a matrix. This cross-case synthesis identified which themes were shared across several organizations (therefore probably generalizable) and which were unique. For example, all instances showed the theme of "limited resources," but "union resistance" was not relevant in any case (none were unionized workforces).

Framework Synthesis: We looked at a "best-fit" framework synthesis method depending on the themes and patterns. To find gaps and required changes, we contrasted our results with current SMS frameworks (ICAO/FAA components) and theoretical insights (such as change management steps). We basically inquired: For these small organizations, which aspects of the standard SMS framework are functioning or not functioning? What more support or simplification do they require? The suggested new framework's development was guided by this approach. We drafted an initial framework outline (with suggested components and phases) and then iteratively refined it in light of case evidence, so guaranteeing that every component of the framework was based on the observed data or literature.

We guaranteed validation techniques including triangulation (corroborating interview claims with document evidence or many interviewees), member checking (sending summaries to key interviewees at each company for feedback and confirmation), and maintaining a chain of evidence from raw data to conclusions throughout analysis. Especially considering the relatively tiny sample of cases, these methods increase the validity of qualitative results.

The result of the study was a set of important insights on success factors and obstacles that directly guided the design of the scalable SMS framework detailed in the following sections. We sought to obtain insights transferable to other small U.S. aviation maintenance companies beyond those examined by using a consistent analytical lens across several cases.

Findings

Despite differences in size, specialization, and SMS maturity among the case study organizations, a strikingly consistent set of **barriers and needs** emerged. Small maintenance operations face a unique context: they operate under tight economic pressures, lean staffing, and often informal cultures, which influence how (or if) an SMS can be implemented. Below we detail the major findings, including key barriers, common safety management practices (or lack thereof), and elements that appear most feasible and beneficial for an SMS in these settings.

Key Barriers to SMS Implementation

1. Human and Financial: Resource Limitations Every instance noted limitations in allocating time, money, and people to official safety management. Unlike big MROs, small shops lack safety departments; usually, the owner or quality manager is expected to handle safety management in addition to other responsibilities. Many managers voiced worry that following FAA recommendations would call for employing at least one more full-time contractor or staff member, which their present financial situation could not allow. This fits with industry trends; NBAA pointed out that small businesses sometimes require "extra full-time staff or outside contractors to run the [SMS]." For companies with limited profit margins, such hires are rather expensive. Moreover mentioned as disincentives were direct expenses like software systems, SMS training courses, or consulting services. For instance, in Case B, the responsible manager said, "I received a quote for a 'SMS in a box' software, and it was more than our annual training budget. That is simply unaffordable. Likewise, the owner of Case D was the responsible manager, head inspector, and present on the shop floor showing how one individual wears several hats, therefore restricting capacity to create fresh safety procedures.

2. Many believed current SMS systems were too complicated and paperwork-intensive for a small business. Many interviewees referred to SMS documentation they had seen from bigger firms as "bureaucratic." Uncertainty was also caused by the absence of a Part 145 SMS mandate in the United States (until now); some people were in "wait and see" mode, not wanting to put effort into things until they were clear. Management acknowledged in Cases A and D (which had no SMS) that they were only vaguely aware of SMS ideas, considering them for airlines. The FAA is progressing toward rulemaking, thus this lack of knowledge and preparation is dangerous. Indeed, as FAA critics pointed out, the Part 5 rule was viewed as "not mak[ing] sense for a single pilot or very small operator" without modification. Although maintenance companies are not single-pilot operations, the feeling is comparable: if one person has to officially document and record every safety decision, it may take away from crucial responsibilities. All things considered, these companies were reluctant because of the absence of specific criteria defining what a minimal yet compliant SMS should be. One quality manager stated, "We'd use an SMS template for a shop our size if someone would just provide us one. Otherwise, it seems like groping in the dark.

3. Safety Culture and Communication Deficiencies: Culturally, small maintenance teams tend to communicate face-to-face all the time, which is a strength but also contributed to informal handling of safety concerns that could bypass documentation. Under-reporting of

events and hazards was a pattern observed. Many technicians said they would "just tell the boss or fix it" instead of filing a report should something troubling occur, such as finding a faulty tool or a technician error. Among the contributing elements are: (a) Absence of official reporting system—e.g., Case D lacked a hazard report form or box, so all communication was verbal; (b) Fear of blame or punishment in a close-knit environment—e.g., in Case E, a junior mechanic stated, "with so few of us, if I admit I messed up, everyone will know," suggesting a need for better Just Culture practices; and (c) Complacency or normalization—in some instances, minor events (like tool drops) were seen as routine and not worth reporting, missing chances to learn from near-misses. Usage was restricted even when procedures were in place; Case C's safety manager observed it was mostly the same two people reporting regularly while others seldom did, indicating uneven involvement. Along with example proof, Table 3 summarizes several frequent flaws seen in the safety culture and communication area across the cases.

Table 3: Common Safety Culture/Communication Weaknesses in Cases A–F

Cultural/Communication Weakness	Observation/Evidence	Consequence
Lack of formal hazard/incident reporting	Cases A, B, D: No specific reporting forms or system; relied on ad-hoc verbal communication. One supervisor maintained a personal notebook of problems in Case B; this was not shared or standardized.	Many small hazards or near-misses went unrecorded, which could cause repeats and provide no data for analysis.
Fear of blame (Limited Just Culture)	Technicians in Cases D and E said they were hesitant to report errors. For instance, in Case E, one worker remarked, "Better to quietly fix it than write it up if you break something here." No clear non-punitive policy existed.	Under-reporting and missed chances to find systematic problems; possible concealed incidents.
Informal safety communication	Every instance: Usually, safety information was shared informally, such as during morning conversations. None had lessons learned bulletin boards or regular safety newsletters. Part of voluntary SMS, Case C held quarterly safety meetings; attendance was occasionally uneven.	Important information—such as new manufacturer safety bulletins or lessons from incidents—may not reach all staff members consistently.

Inconsistent training/refresher	Cases A, D: No planned safety training; any training was on-the-job. Though mostly quality/compliance oriented, Case F (with QMS) did annual training; it was not proactive safety. Survey in Case F revealed 40% of technicians had not had formal safety training in over two years, comparable to Jaiswal et al. results in UAE.	Employees might not know current safety practices or reporting processes; skill fade in safety subjects.
Reliance on individual experience	Many older technicians in Cases A and B claimed they depend on their "20+ years of experience" to remain safe; younger employees pick up knowledge by observation. Although experience is important, this mindset occasionally undervalues official risk assessment (e.g., ignoring OEM-supplied maintenance safety checklists).	Experienced personnel may normalize risk, which creates possible blind spots; lack of methodical approach means safety relies on people instead of a consistent process.

These cultural elements highlight the need of behavioral and attitude changes since just requiring policies is insufficient. The results indicate that creating a non-punitive, reporting-friendly culture is both vital and difficult in small organizations.

Informal Procedures and "Single Point" Knowledge: In every instance, we discovered that many safety-critical tasks were managed informally or focused in one person's mind. For instance, experienced staff members' intuition and vigilance rather than a formal procedure guided hazard identification. Though there was no checklist or record, Case A's chief mechanic informally inspected the hangar every evening for anything amiss—spills, tools left out, etc. If he were absent, the job might be missed. Likewise, without records, risk assessments—determining whether something was safe to continue—were conducted on the fly. Although this adaptability can be a benefit of small businesses (fast decision-making without red tape), it also implies lack of consistency. Safety criteria of one individual could differ from those of another. One significant flaw is the absence of root cause study when events take place; in Case B, a dropped aircraft panel incident was merely fixed and addressed briefly; no official investigation or corrective action plan was created. Lack of structure implies that lessons might not be completely learned or institutionalized. This result supports studies claiming that while small businesses may already take reasonable safety measures, "for the system to be effective, these components must be documented, tracked, and tweaked where necessary". The difficulty, then, is turning casual knowledge into a straightforward system of record and action.

Finally, outside elements might either inspire or hinder. Some people on the barrier side thought regulatory paperwork—FAA inspections, etc.—already took enough time, thus SMS could be viewed as "just another compliance duty." On the motivating side, some observed that client needs—particularly for those servicing commercial operators or international consumers—were beginning to drive them toward SMS. Case E's quest for EASA approval practically compelled them to start SMS implementation, which they might not have done otherwise. Being ISO 9001 certified (Quality Management System) in Case F offered a systematic approach that could be extended to SMS, implying that harmony or integration with current compliance systems would minimize duplication. For a tiny business with infrequent accidents, though, assessing that advantage is challenging.

All in all, the obstacles confronting small maintenance companies are not only lack of will or negligence; they are structural (limited people and money), perceptual (seeing SMS as overkill), and cultural (ingrained informal norms). Any system seeking to use SMS at this size has to address these issues directly. The results also underlined certain good points we may develop: close communication (even if informal), highly experienced employees, and the capacity to adapt quickly (no large bureaucracy). The framework will have to maintain these strengths even as it adds sufficient formality to create a functional SMS.

Effective Practices and Elements for a Scalable SMS

Our research also found or prompted several small business-friendly practices among the difficulties. These are the "seeds" of a scalable SMS—practical actions these companies can take that fit SMS goals:

Management Participation in Safety Initiatives: Employees reacted favourably in situations when safety was directly addressed by the owner or manager. Case C, which had a voluntary SMS, had the general manager conduct quarterly "safety roundtables" where any technician could raise issues. Technicians in that situation said they felt "the boss listens now" and that some long-standing problems (such as poor lighting in a work area) were resolved as a consequence. This shows that even without a major program, visible leadership commitment can motivate development. Inspired by one manager who attended an FAA Safety Stand-Down seminar, many companies adopted a policy of beginning weekly staff meetings with a quick safety issue. Where it was applied, it often kept safety "on the radar." Except for managerial effort and time, such practices cost little or nothing.

Two instances (B and C) had very straightforward hazard tracking systems. With a status column (open/closed), Case B's quality manager built a spreadsheet "safety log" noting any

safety-related item that arose. Though not a complex risk register, it helped to make sure problems weren't forgotten. Under the voluntary SMS, Case C had a more formal log but still quite basic. A one-page form allowed employees to report risks; the safety manager would enter them into the log and take appropriate action. Interviewees in both situations said that having a list of problems and regularly reviewing it helped to provide some responsibility and discipline. At small scale, they also said you don't need costly software; a shared Google Sheet or clipboard could suffice if someone is in charge of maintaining it. Scaled appropriately, the common thread is documentation of hazards and follow-up actions. This is SMS criteria for hazard identification and safety assurance but adjusted for low resources.

Small businesses can't afford to employ committed safety experts, thus a good approach is to give current employees safety responsibilities as secondary duties. For instance, Case F designated one of their knowledgeable technicians as the "Safety Champion"; he received extra training and was tasked with organizing safety meetings and reporting to management on safety issues. Though it gave a point person for day-to-day SMS activities, this did not absolve the responsible manager's duty. In Case C, which had about 45 people, they really created a small safety committee of three staff members—the manager, one supervisor, one technician—who met monthly. Though small and informal enough not to be daunting, those structures provided safety management some formality. You may not have a complete Safety Office, but even a committee of 2–3 can serve the purpose of examining hazards and propelling safety enhancements, hence reflecting a scalable approach to governance.

Using Current Quality and Compliance Procedures: Maintenance teams usually have additional oversight procedures (such as quality inspections, tool control audits, etc.). Cases that included SMS duties into current procedures discovered it more efficient. For example, safety questions were added to Case F's ISO 9001 quality audits (such as asking whether any unreported events occurred). Case B's FAA repair station audit prep was used as a chance to conduct a more comprehensive safety review. Essentially, SMS components were addressed without distinct events by piggybacking on regular audits or meetings—such as annual repair station renewal or client audits. Avoiding duplication of audit weariness, this integration is a sensible approach to carry out Safety Assurance tasks.

A clear conclusion was that trying to do everything at once is not practical. The organizations that advanced did so slowly. Starting in year one, Case C simply developed a safety policy and hazard reporting system; in year two, he included internal audits and training courses. They controlled change more easily by phasing it in. Employees also got to witness

some "quick wins"; for example, one of the first reports following the implementation of hazard reporting resulted in a correction of the hangar air conditioning, which was both a comfort and safety concern. Announcing that success motivated additional reporting. The data and interviews strongly backed this idea of a phased roadmap or maturity progression: "Don't try to boil the ocean," as one manager put it. Rather, give priority to important components first (such reporting, management dedication), then grow.

These efficient strategies taken together fit with much of the research on what a right-sized SMS should include: leadership, reporting, training, monitoring, all carried out in a straightforward, minimal-bureaucracy way. They provide the foundation for the suggested framework. Our results show that four pillars reflecting ICAO's, but with a modified emphasis, form the foundation of a successful scalable SMS model for small maintenance companies: (1) Leadership & Safety Culture as the driving force; (2) Reporting & Documentation kept simple; (3) Training & Promotion integrated into daily work; and (4) Performance Monitoring that starts basic and grows in sophistication. A clear implementation roadmap—dividing the path into phases—was also noted as a requirement to enable these companies to give SMS priority and progressively develop it.

We combine these ideas into a useful framework in the following part. We show the four-tier model and describe how each tier may be scaled depending on organizational size and maturity. We also offer a matrix and phased plan (from start-up through growth to full integration) that small organizations can follow, which addresses the obstacles and leverages the effective practices identified here.

IV. Proposed Framework

Using the results above and best practices from both the research and literature, we suggest a 4-Tier Scalable SMS Framework designed for small aviation maintenance companies. Comprising four fundamental tiers or focus areas that parallel the traditional SMS components but presented in a user-friendly manner, the framework also offers direction for expanding each tier to fit the size and maturity of the company. The four tiers are: (1) Leadership Commitment & Safety Culture, (2) Simplified Hazard Reporting & Documentation, (3) Integrated Safety Training & Promotion, (4) Progressive Safety Performance Monitoring. Aligning the SMS components with organizational levels and safety culture, Figure 1 offers a conceptual summary of how these factors interact inside the framework of a small company.

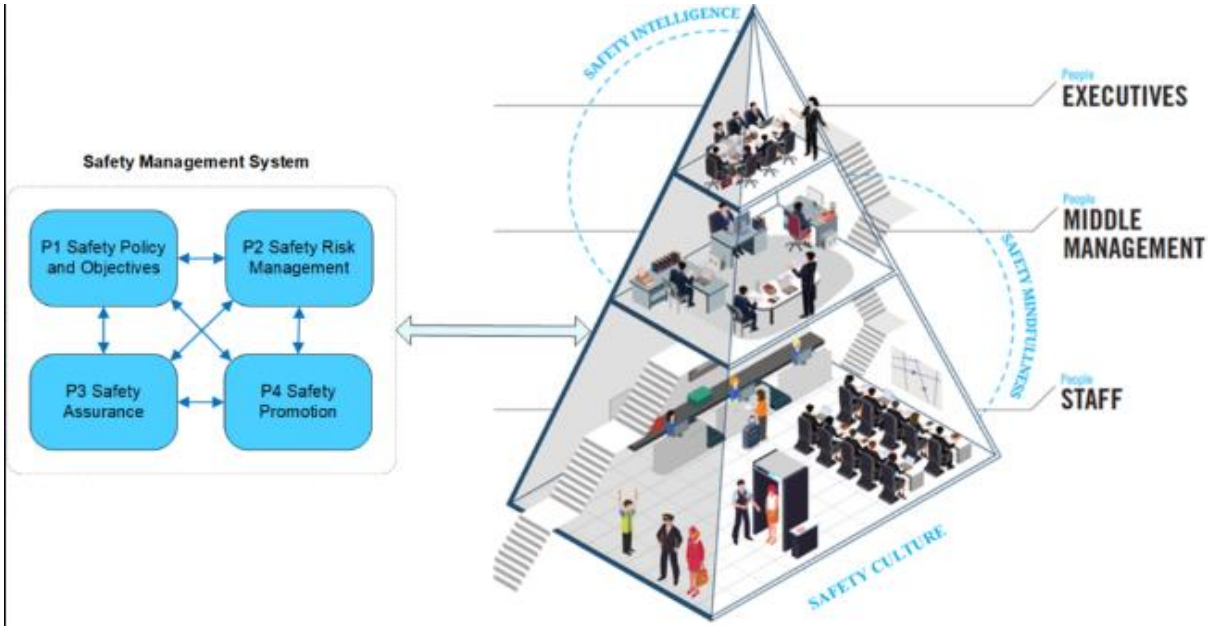

Figure 1: Scalable SMS in a Small Company: SMS Component Integration with Organizational Levels The four SMS components—P1–P4—are shown on the left as linked parts making the official Safety Management System. A tiny company's pyramid structure—staff at base, middle management, and executives at top—shows how safety culture supports all levels, with safety intelligence at management levels and safety mindfulness at the staff level. An efficient SMS calls for bridging these elements even in a small maintenance shop: leadership (executives) commitment drives the culture, information flows (reporting and communication) guarantee staff mindfulness of safety, and management uses intelligence (data, oversight) to make informed safety decisions. The four levels of the suggested framework serve to reinforce these connections in a scalable way, therefore guaranteeing the SMS is embedded in the people and processes of the organization rather than a stand-alone box.

The framework is "tiered" in that every focus area can be developed somewhat independently and each can be scaled up as the organization grows or matures in safety management. Below we outline every tier in depth, including its goals, important components, and small business advice. We also provide a scalability matrix (Table 4) showing how the practices in each tier can develop from a very basic level (appropriate for a micro-operation or initial implementation) to a more advanced level (appropriate for a larger or more mature operation). At last, we provide a phased implementation roadmap guiding companies to use the framework stage by stage by sequencing these tiers into stages (Start-Up, Developing, Intermediate, and Institutionalized).

Tier 1: Leadership Commitment & Safety Culture

Tier 1 is the basis; it includes the organizational safety structure, management's dedication to safety, and the development of a positive safety culture. For a tiny maintenance company, Leadership Commitment is the responsible manager (usually the owner or chief executive of the repair station) visibly and actively supports the SMS. This calls for a clear safety policy (even a one-page written statement) that expresses the company's safety goals and dedication to follow safety criteria. It also means specifying safety duties and roles inside the organization's small staff. Someone in leadership has to be responsible for the SMS even in the absence of a specific safety manager; important staff members should have safety responsibilities specified (e.g., the lead technician might also serve as safety coordinator).

Equally as crucial is developing a Safety Culture that supports honest reporting and error learning (Just Culture). In a tiny company, the leader's views greatly shape culture. Employees will conceal errors if the owner responds angrily; on the other hand, if the leader views errors as chances to grow and appreciates staff members for speaking out, a trust-based culture develops. Management should clearly state that reporting a safety issue or honest error will not result in punishment for anyone and should follow that commitment. Daily conduct and a straightforward policy statement can help to achieve this.

Small Orgs' Main Actions (Tier 1):

Create and sign a short, customized Safety Policy. For instance, "Company XYZ is dedicated to the utmost degree of safety. Management will make sure every staff member is trained and motivated to report risks. We will always enhance our safety measures and follow every legal need. Display this in the office to indicate dedication.

Designate an Accountable Executive for SMS—probably the owner or GM—and specify any supporting duties. Many small businesses allow one person to be named the safety point-of-contact; for example, "Safety Officer" in a part-time capacity. Though final responsibility lies with top management, this individual coordinates safety initiatives and gathers reports.

Create consistent safety communication from leaders. A brief monthly safety memo or a regular agenda item for the boss to address safety at every staff meeting could be included. The material could be a shout-out honoring an employee's good catch (positive reinforcement) or lessons from a recent event.

Practice "walk the talk": leaders should visibly participate (do a safety walkaround, ask employees if they have any concerns) and model safe behavior (e.g., wearing protective

equipment, following procedures). The attitude of the team is significantly shaped by this visible dedication.

Apply Just Culture ideas: clarify that only really reckless disregard or willful violations will face possible punishment by classifying behaviors—human error, at-risk behavior, and reckless behavior. Coaching or system improvement will address everything else; not punishment. When events happen, this can be expressed verbally and by example.

For a very small business (5–10 people), Tier 1 might be as straightforward as the owner being aware of safety in every choice and maintaining an open-door policy for safety concerns. More structure can be added as the company expands (20–50 people): perhaps create a Safety Committee comprising staff members from various departments that meets quarterly. More official safety goals could be established, such as target zero OSHA reportable injuries or certain training completion rates. In a bigger small-business (say nearing 100 people), one could engage a committed safety manager. But the core stays: visible dedication of leaders and development of a safety-first culture. Later, Table 4 will show these gradations.

Tier 2: Simplified Hazard Reporting & Documentation

Tier 2 emphasizes building a hazard/occurrence reporting system and the least documentation required to control safety data. The aim is to develop a means for the company to monitor reports of hazards, incidents, and near-misses by staff members easy, and one for tracking such reports under resolution. The system has to be straightforward, not tech-heavy if it is to scale. Rather than sophisticated databases, small organizations can begin with paper or basic digital forms. The focus is on reducing reporting obstacles and making sure problems are recorded and not lost.

This level deals with the absence of official procedure noted in the results. Even a small business can start carrying out the Safety Risk Management function—identifying hazards, evaluating their risk, and controlling them—in a systematic manner by implementing a non-punitive, simple-to-use reporting tool. Documentation here does not mean lots of paperwork; rather, it means just maintaining a record of reports, decisions, and actions—e.g., a log or spreadsheet—to offer continuity and knowledge.

Small Orgs' Main Actions (Tier 2)

Establish a Hazard Reporting System: Design a straightforward incident/hazard report form. It might be a half-page template (requesting what was seen, when, and recommendations)

in the break room or as a shared file. If that's what staff members want, accept reports in any format—even text messages or emails; the main thing is to gather the data. Allow anonymity by providing a drop box or email address for reports to be submitted.

Guarantee Non-Punitive Reporting Policy Emphasize that reporting is blame-free (links to Tier 1 culture). The form can be used to print this, for example, "Reporting hazards or errors will not cause punitive action. Your assistance in enhancing safety is much appreciated.

Keep a straightforward Safety Issues Log. This might be notebook or Excel spreadsheet. Note each report or found hazard, who is in charge of follow-up, and status (open/closed). For each, record the action taken or risk assessment (even if qualitative like "minor issue - fixed next day"). Essentially, this log is a very simple version of the safety risk register.

Always give feedback to the reported (if known) individual. In a small team, this could simply imply bringing it up at the next morning meeting: "Thanks to John for reporting the frayed wiring on the test bench; we have replaced it and also checked all other benches." This loop promotes ongoing reporting.

Apart from the log and reports, the only other papers could be a short SMS manual or company manual section outlining who is responsible for what and how reporting functions. A 2-3 page procedure outlining: safety policy (from Tier 1), how to report hazards, how issues are investigated and closed, and how often management reviews safety is recommended. Shortening it makes it updateable and usable.

Implementing Tier 2, even informally, helps the company to do the fundamental of hazard identification and risk management. For instance, Case B's spreadsheet of problems fulfilled precisely this function in place of a sophisticated system. With time, the log's patterns can be examined; for example, ongoing problems with a particular tool could drive acquisition of new equipment.

Tier 2 Scaling Up Considerations: At first, the report count could be low due to under-reporting. Increased reporting in the short term should be used to gauge success; this is a good sign of involvement even if it means revealing more issues. The reporting process can be scaled by: As the company expands or the system develops, Introducing an electronic reporting tool (even a simple online form or an app) if the volume grows.

Start simple, perhaps just High/Medium/Low, and define categories and risk levels for reported problems to give responses priority (e.g., a risk matrix).

Maintaining more thorough records for major events (create a brief investigation form for anything above a minor concern).

Should there be several shifts or sites, make sure the reporting system functions across all of them; maybe a centralized log available to all supervisors.

Eventually, for a bigger small business, the system could link to the FAA's Aviation Safety Reporting System (ASRS) for particular events or work with quality reporting. But at the fundamental level, it's about a consistent approach to record and handle safety issues.

Tier 3: Integrated Safety Training & Promotion

Tier 3 is the training, education, and promotion activities that foster knowledge and competence of safety among all personnel—essentially the Safety Promotion pillar, scaled to small operations. "Integrated" emphasizes that in a small business, training and promotion should be interwoven into daily work practices rather than isolated or excessively formal. The goal is to make sure workers can meet their safety obligations and that safety stays a visible, talked about element of the company.

Integrated Safety Training might be quick, regular training moments rather than uncommon, large courses for a small maintenance company. It also covers SMS onboarding training for new employees as well as their responsibilities therein. Promotion is the means of conveying safety information—for example, industry news (such FAA safety bulletins), lessons learned from events, and honors of accomplishments (like reaching a particular number of days without a lost-time injury, if relevant).

Small Orgs' Main Actions (Tier 3):

Include quick safety briefings in current gatherings. Many small businesses hold daily or weekly meetings; spend 5 to 10 minutes on a safety issue during that time. Rotate subjects pertinent to maintenance: e.g. human factors (fatigue, distractions), appropriate tool control, use of personal protective equipment, or discussion of a recent incident (internal or from industry). Over a year, these accumulate to a thorough internal training course.

Initial SMS Training for Staff: When implementing SMS, take time to educate employees on what SMS is, why the company is doing it, and how they can participate. This doesn't have to be a formal classroom; it could be an all-hands tailgate talk for 30 minutes covering the reporting system, their safety responsibilities, and the company's safety policy. Make sure

everyone knows the fundamentals; perhaps provide a one-page summary of the SMS and important contacts.

Encourage seasoned employees to guide juniors on safe practices. Since much information is tribal in small businesses, formalize it somewhat by having mentors address particular safety issues. For instance, when instructing someone on how to rig an engine, the mentor also stresses hazard awareness (pinch points, eye protection, etc.). In this manner, technical training becomes safety training.

Make the most of free training tools by using free/external resources. Often, FAA and industry organizations host webinars, online courses, or local FAA Safety Team (FAASTeam) seminars pertinent to maintenance safety. Rotate staff attendance or viewing of these and talk about important takeaways. For example, one person may attend a webinar on human factors and then inform the team on what was learned (this was successfully done in Case F).

Safety Promotion Tools: Maintain visibility of safety. In a small facility, a simple bulletin board in the break room can serve to post safety tips, copies of anonymous incident reports (with lessons learned), or industry accident summaries. Change it often to encourage reading. Furthermore, when changes are made from a safety suggestion, post a note saying "Fixed: added new lighting in Bay 2 as suggested by our team - thanks for speaking up about this hazard!"

Although not required, motivating technicians to seek extra certifications or training (such as an OSHA 10-hour safety course, or aircraft particular maintenance courses) indirectly helps SMS by increasing general professionalism and safety awareness. The business can reward or acknowledge staff members who strengthen a learning culture.

Tier 3 Scaling Up Issues: Training might be quite casual at first. Consistency is essential; ensure at least monthly some kind of safety communication/training. The organization can create a training matrix to guarantee every employee receives specific safety trainings regularly (e.g. everyone gets human factors training every 2 years, either in-house or external).

Simply keep a record of what subjects were discussed and who was there to document training. This can later prove to auditors that ongoing training is taking place.

For somewhat bigger companies, think about half-day offsite safety meetings or brief annual safety seminars where several safety issues or drills—such as emergency response drill—are practiced.

Include safety objectives/incentives such as a target of 100% of staff members turning in at least one safety improvement idea annually and a modest reward—such as a gift card or acknowledgment—for achieving it. This encourages participation.

Use multimedia as technology permits: during a meeting, share a pertinent short safety video from YouTube or an industry source to generate conversation.

Should the business expand, a training budget might be set up to send one or two individuals annually to professional safety training; those individuals could then become internal trainers (train-the-trainer model).

Tier 3 avoids "training fatigue" by always keeping the training program practical and relevant to daily work, but scales by progressively formalizing and broadening it. The final goal is an inherent safety consciousness whereby workers automatically think safety in every activity—thereby attaining an informed, reporting, and learning culture.

Tier 4: Progressive Safety Performance Monitoring

Description: Implemented in a progressive way, Tier 4 relates to Safety Assurance—monitoring safety performance and always enhancing the system. Initial safety performance monitoring might be quite basic for small companies (since with small numbers, you have few data points). Though, even a tiny store can monitor particular metrics and conduct fundamental audits or reviews to confirm the effectiveness of risk controls. "Progressive" means the complexity of monitoring can develop with time.

At the most fundamental level, it could mean the manager routinely examining the hazard log (from Tier 2) and verifying that problems were handled efficiently—basically internal assurance that issues are being handled. It also means occasionally spotting changes or new risks (Management of Change) in a straightforward manner, such as considering the safety effect if the business assumes new kind of repair or equipment. The company could, over time, carry out more official audits, staff safety questionnaires, or establish particular safety performance goals (such as lowering rework or customer-reported problems).

Important Actions for Small Orgs (Tier 4):

Management should establish a timetable—say, monthly or quarterly—to review all open hazard reports, incidents, and any safety initiatives. In a 30-person company, it could be a safety committee meeting; in a small organisation, it could be just a manager doing a self-audit using a checklist. The goal is to make sure the SMS is operating. Is closing happening on reports?

Have we observed ongoing problems? What could that mean? This is a feedback loop for ongoing development.

Easy Measurements: Choose a handful of reasonable safety measures for your company. For instance: monthly hazard report count; days since last lost-time injury; FAA or customer safety-related audit findings. Monitor these on a basic whiteboard or chart. Discuss why if a measure goes in the wrong direction—e.g., reports drop to zero or spike unusually. Even qualitative measures such "employee safety recommendations" matter. The ATSB's study found that while SMS-equipped companies often report lower accident rates, these leading indicators are more relevant daily given that accidents are (hopefully) very rare in every small organization.

Perform regular safety inspections of the facility and operations. Many people probably do this for OSHA compliance: a quarterly walk-through with a checklist (ensuring fire extinguishers in place, no tripping hazards, MSDS up to date, etc.). Broaden it to cover evaluating adherence to your own safety policies, such as whether individuals are using the hazard forms. Are maintenance entries being done properly to prevent mistakes? etc. Have someone not often in that area conduct the inspection for fresh eyes, if at all possible, even swapping with a peer from another small business if one is available.

Management of Change (MOC): In a simplified sense, promote forward thinking about safety when changes take place. For example, conduct a fast risk assessment if you acquire a new piece of equipment: what new risks could it create (noise, electrical, training required)? Talk about what variations in procedures or tools could influence safety if the company is about to start servicing a new aircraft model. Record any follow-up actions—such as requiring training or new protective equipment—and follow them. Though a brief MOC form or perhaps just meeting notes could be used to implement this proactive measure, it guarantees safety is not fixed.

Analyze the data collected over time to find areas for development. For instance, if over a year you observe that "human error in maintenance steps" was a contributing factor in three occurrences, perhaps it is worthwhile to consider a human factors refresher training (Tier 3) or to modify a procedure to include a verification step. The SMS should change; maybe fresh risks call for new controls, such lithium battery handling as those become more prevalent. Motivate staff members to propose remedies rather than only notify issues.

Tier 4 Scaling Up Considerations: At first, monitoring is only internal and qualitative. With more data, the company can act more:

Set safety performance targets that are realistic (e.g. “complete 100% of scheduled safety inspections this year” or “increase hazard reports by 50%”). Keep track against them. This provides a feeling of success and direction.

Annual employee safety climate surveys will help to measure perception and areas for improvement; simple templates exist. Results are simple to read with few staff members, but if at all feasible, please anonymity.

Should the company expand, think about peer reviews or external audits of the SMS to obtain outside input; this might involve participating in an audit program or having a consultant examine it occasionally.

Every year, conduct a simple trend study using data from hazard logs and incidents. It might be as easy as classifying all reports—e.g., housekeeping, procedural, human error, technical failures—and determining which category occurs most often and emphasizing it.

When mature, the SMS should be able to predictive risk management, or foreseeing problems before they happen (the final aim of Safety-II and resilience). For a small organisation, this could show as an intuitive team awareness of what areas are most dangerous and constant vigilance in those areas—a cultural result of continuous monitoring and learning.

These four levels taken together offer a thorough yet scalable framework. They reflect ICAO's elements—Policy -> Tier1, Risk Mgmt -> Tier2, Promotion -> Tier3, Assurance -> Tier4—but are converted into practical plans for small businesses. A small repair station may begin with extremely simple tasks in each tier and increase complexity as required under the framework.

Phased Roadmap and Scalability Matrix

We offer a Scalability Matrix (Table 4) showing incremental levels (from Level 1 to 4) for each of the four tiers to help further show how a small business can advance in applying this framework. Roughly speaking, these levels correspond to SMS maturity stages: Level 1 (Initial/Basic), Level 2 (Developing), Level 3 (Functioning), Level 4 (Institutionalized). This matrix allows a company to self-evaluate its position in each tier and strategize what "next steps" would advance them to the next level.

Table 4: Scalability Matrix – SMS Elements at Basic vs. Advanced Levels for Small Maintenance Orgs

SMS Tier	Level 1: Basic (Start-Up)	Level 2: Developing	Level 3: Functioning	Level 4: Institutionalized
Leadership Commitment & Culture	Safety policy is a spoken commitment; responsible manager makes safety choices case-by-case. Minimal role documentation.	Posted written safety policy. Designated accountable manager as SMS lead; staff informal safety champion found. Management often shows support (e.g., meeting discussions).	Assigned official duty (committee or safety officer). Management evaluates safety performance on a regular basis. Everyone knows and follows Just Culture policy.	Company goal emphasizes safety as a fundamental value. Every decision shows leaders' clear prioritization of safety. There is great confidence; staff members openly voice concerns. Safety duties included in job descriptions.
Reporting & Documentation	No official system; problems addressed ad-hoc. Perhaps a manager's notebook of issues.	Email set up or straightforward hazard report form. Issues are tracked by a simple safety log. Some problems recorded and handled; yet, reporting is minimal.	Employees make moderate use of an active reporting system. Every accident or hazard is recorded and tracked to closure. Created documentation (SMS manual/procedure) addressing the reporting and response process.	Strong reporting culture: staff members report even little near-misses. Logged hazards are tracked by trend. Though thorough, the documentation is user-friendly. Perhaps with basic tracking software.

Training & Promotion	Safety training is on-job only; there is no formal course. Safety issues seldom addressed directly.	All were given first SMS briefing. Occasionally included in meetings is a safety moment. Maybe one basic training—e.g., human factors briefing—held. Minimal visual aids (posters).	Regular safety communications: monthly safety topic, quarterly briefings. There is a training matrix for important subjects, albeit small. Safety orientation is given to new employees. Acknowledgment of safety recommendations put forward.	Ongoing learning culture: at least yearly thorough training, toolbox talks, and regular refreshers. Newsletters on safety or board actively kept up. Staff members very conscious of SMS procedures and safety best practices.
Performance Monitoring	Reactive approach: just clear issues tackled. Lack of audits or specified safety criteria.	Management sometimes checks the hazard log. At least one tracked safety measure, even if only "# of reports." Informal occasional walk-through inspections.	Set key safety performance indicators (KPIs), such as incident rate and audit results. Regular internal audits or inspections take place (e.g. quarterly). New projects' management of change process began. SMS data used to drive changes.	Proactive strategy: objectives for development defined (e.g. lower small accidents). Annual safety data trend analysis. Official management assessment of SMS efficacy (similar to a management review meeting). Ongoing visible improvement (procedures revised in light of audit results, etc.).

Table 4 illustrates that even at Level 1, an organization can start with basic components (some commitment, informal tracking), and at Level 4 it practically has a fully realized SMS suitable to its size. Though not every small organization will reach Level 4 fast, even Level 2 or 3 will significantly improve safety management relative to no SMS.

At last, we suggest a Phased Roadmap to carry out the framework in reasonable increments. Four stages make up this road map, which correspond to ICAO's concept of implementation phases and the levels above:

Phase 1: Start-Up (Months 0–3) - Emphasize Tier 1 (Leadership & Policy) and building Tier 2 fundamentals. Management officially commits to SMS (issue safety policy), assigns

responsibilities, implements the hazard reporting system, and informs staff members of these. Start recording problems. Roughly corresponds to Level 1 in matrix for all tiers.

Phase 2: Foundation (3–9 Months) Phase 2: Foundation (Months 3–9) Expand Tier 2 and Tier 3. Deeds: Respond to first reports to encourage and normalize reporting; begin Tier 3 regular safety talks/training; record straightforward processes. Also, handle any rapid fixes from early hazard reports to indicate progress. Core SMS functions are operational by end of Phase 2 (reports coming in, being handled, staff trained on process). For most levels, this advances the organization to Level 2.

Expansion in Phase 3 (Months 9–18) Enhance integration and strengthen Tier 4 (Monitoring). Deeds: Management holds first official SMS review meeting (to assess progress). Add some internal audit checklist items and KPIs; fix any shortcomings discovered. Perhaps run a safety culture survey to measure progress. Keep up your training and promotion campaigns with greater organization; perhaps develop a training calendar. The SMS should be operating more smoothly at this stage with more involvement. Aiming for Level 3 capacity.

Phase 4: Institutionalization (beyond 18 months) - Strive for ongoing development and long-term viability. Deeds: Revise SMS documentation to show changed procedures; think about matching with any forthcoming legal requirements (so if FAA Part 145 SMS rule comes, the system meets those requirements). The SMS is integrated into regular business; every project takes safety concerns into account; staff members view SMS as "how we do business." Though it's not required, the company at this point could look for outside certification or acknowledgment—for example, FAA's SMSVP recognition or an industry safety award. This is Level 4, a mature small-org SMS.

The timeline can be flexible; very small organizations might take longer if they have to do this in between other responsibilities, whereas a somewhat larger one might speed up by devoting more effort early on. The phased strategy guarantees that early victories—such as addressing first hazards and having management demonstrate commitment—set a good foundation and that the system is not over-engineered at the beginning but rather let to develop organically.

The suggested framework and roadmap directly address the identified obstacles by minimizing needed resources (emphasizing low-cost, straightforward tools), simplifying complexity, and integrating the SMS into the current organizational rhythms (thereby lessening the sense of a "extra" load). It also makes use of what was effective in the instances: strong

leadership involvement, straightforward reporting, on-the-job training, and incremental development.

The following part explains how expert input and a pilot implementation validated and honed this framework, therefore proving its relevance and efficacy in a real-world environment.

V. Validation and Expert Review

Having created the scalable SMS framework, we followed a two-step validation procedure: first, collecting industry expert feedback using a Delphi technique and focus groups; second, carrying out a short-term pilot implementation in a volunteer organization (one of the case study companies) to see the framework in action.

Delphi Panel Comments

Ten professionals made up a Delphi study conducted to assess and improve the suggested roadmap and framework tiers. The expert panel comprised a mix of stakeholders: three FAA aviation safety inspectors (with Part 145 oversight experience), two safety managers from larger MROs, three owners/managers of small aviation maintenance businesses (similar in profile to our study cases but from different regions), and two independent aviation safety consultants. This combination guaranteed the presence of regulatory, practitioner, and business viewpoints.

Three rounds made up the Delphi approach:

Experts received a framework summary—four tiers and the implementation matrix/roadmap—and were asked open-ended questions regarding its clarity, viability, and any deficiencies or issues in Round 1. They gave individual written comments.

Round 2: The panel received a summary of the feedback anonymously. Key points brought up in Round 1 were: the need for more precise definition of roles in Tier 1 for very small businesses; recommendations to add more examples of metrics in Tier 4; and a question on how to handle regulatory record-keeping requirements simply. Keeping these issues in mind, the panelists next re-evaluated the framework and responded to particular inquiries to reach agreement (e.g., "What is the minimum documentation needed at Level 2?").

Presented for last review and rating was Round 3: A near-final framework, updated according to prior comments. Panelists could provide last comments and rated their agreement

on a Likert scale with statements such "The four-tier framework is appropriate and comprehensive for small maintenance organizations."

The Delphi findings revealed great framework support and agreement. By Round 3, every one of the ten specialists either "Agreed" or "Strongly Agreed" that the framework tiers covered the essential elements required. There was agreement that small businesses could carry out. Especially, FAA inspectors liked the scalability matrix; one said, "It offers a real road for small repair stations; something like this could be used in FAA guidance to clarify how Part 5 can scale." Panel small business owners were also upbeat, but they stressed the need of showing return on investment for the time spent. One suggested stressing in communications that SMS can lower rework and incidents, therefore saving money over time, which we included into training recommendations.

The panel's comments prompted some changes: we included a template example for a combined safety/quality meeting agenda (to assist integrate SMS with current meetings), emphasized that even in a 5-person shop, at least one safety review meeting should occur annually, and included the concept of peer mentoring between small businesses as a chance for ongoing improvement (one expert observed that small repair stations in his area created a safety roundtable to exchange experiences). These changes improved the user-friendliness and strength of the system.

A regional aviation maintenance conference also saw a focus group session run with roughly 15 FAA staff members and small MROs to address the feasibility of the framework. We offered a 20-person avionics shop implementation of the framework as a theoretical case and sought responses. Attendees thought the method "refreshingly practical" in comparison to generic SMS advice, therefore the focus group comments closely matched the findings of the Delphi panel. One comment was that they especially appreciated the idea of scaling paperwork: "you mean my 5-page manual could actually suffice – that's great!" Though they acknowledged it was feasible if done infrequently but meaningfully, some participants were wary about the time required for internal audits (Tier 4). This open conversation confirmed again that the framework spoke to the intended audience.

Pilot Implementation

We applied the framework on a trial basis in Case B—a genuine small maintenance company (28 employees, piston-engine overhaul shop) from our study—to validate it further. Management of Case B was eager to formalize their safety procedures to satisfy expected future needs and offered to test the new framework for six months.

Pilot Strategy: The first three months were treated by us as setting Phases 1 and 2 (Start-Up and Foundation); the following three months were treated as Phase 3 (Expansion) of the roadmap. At first, our research team helped as facilitators; the company's employees actually carried out the execution:

The responsible manager wrote a safety policy in Month 1 and appointed their quality supervisor "Safety Coordinator" (Tier 1 duties). The SMS project and the revised hazard reporting form (Tier 2) were presented during a brief all-hands meeting. Four hazard reports were filed in the first month; all were fairly small concerns but a good beginning given reporting had been totally verbal.

By Month 3, they had a simple hazard log tracking eight problems—some from reports, others found during a fresh safety inspection round. To address any new Tier 3 concerns, they held bi-weekly safety huddles—15 minutes at shift changes. Already, a significant shift was that one of the technicians actively noted a torque wrench calibration problem before it caused an error—something he acknowledged he might not have mentioned earlier. Management commended the technician and corrected it (recalibrated the tool and verified others), therefore supporting the preferred culture. The SMS method gained confidence from this early "win."

During Month 4-5, we assisted them in performing an internal audit using a basic checklist we gave (Tier 4 beginning). It discovered some holes (e.g., they acknowledged lacking a formal procedure to inform consumers if a post-delivery possibly safety-related error was discovered, which they then developed a procedure for). To track on their bulletin board, they also specified two measures: "number of hazard reports" and "days since last injury." Though none had in the previous year, no injuries happened during the pilot; posting the counter maintained awareness (and some ergonomic changes were started to guarantee that record keeps on).

By Month 6, Case B had basically embraced the framework (about Level 2-3 on our matrix). The responsible manager stated in a debrief interview, "It was a bit of work to get going, but now it doesn’t feel burdensome - it’s just part of how we do things." Knowing we have a means to identify issues helps me to sleep better. The Safety Coordinator observed that staff members were slowly growing more receptive: early doubt was fading as they observed problems being resolved and no one being punished for speaking out.

Pilot Outcomes: Although six months is a brief period to assess actual safety outcome changes (and thankfully no accidents would be anticipated in that time), we found qualitative changes in safety management. Some small hazards that may have persisted before were

handled and safety communication became more organized. For instance, they found some unlabeled chemical bottles during an inspection—a minor OSHA violation risk—and corrected it. Without an SMS-style check, that could have been ignored indefinitely. Staff members said they felt more certain that management is proactive about safety. The firm intends to keep using the SMS and even get ready for FAA's SMS Voluntary Program acknowledgment.

The pilot test gave a real-world sanity check to verify that even a tiny business could carry out the framework without underwhelming disturbance. Importantly, it underlined that management attitude is essential; Case B's leadership was on board, which made all the difference. It could have struggled in a different pilot (Case D first expressed interest but later withdrew, probably because of lack of management bandwidth). This underlines our discovery and framework focus on Tier 1: SMS will not last without leadership pushing it.

All things considered, the expert evaluations and pilot implementation confirmed that the framework is both feasible and efficient in steering small maintenance organizations toward a functional SMS. Experts agreed it addresses a significant void and the pilot showed noticeable changes in safety practices and culture within months. The final framework offered in this paper was shaped by the knowledge gained from these validations.

VI. Discussion

Particularly in the framework of small enterprises, the results of this study and the resulting framework have several significant consequences for both the theory of safety management in high-risk industries and the practical development of aviation safety. We address these consequences, admit the study's shortcomings, and propose directions for further investigation.

Theoretical Implications

One theoretical contribution of this paper is showing how systems thinking and safety management concepts can be operationalized at a micro-scale. Traditional safety management theory in aviation and other fields often assumes a certain degree of organizational complexity—multiple departments, formal hierarchy, plenty of data—which may not exist in a 15-person maintenance shop. Emphasizing adaptability and human-centric approaches over rigorous analysis, our framework carries ideas like Safety-II and resilience engineering into this domain. For example, we gave developing a safety culture and staff awareness top priority instead of, say, using sophisticated safety risk modeling since Safety-II sees people as a source of flexibility and resilience. By doing this, we demonstrated that, if directed properly, the

essence of system safety—identifying and controlling hazards, learning and adapting—can be attained with little structure. Appropriately scaffolded, even tiny socio-technical systems could show the characteristics of a mature safety system (reporting, feedback loops, learning), thus supporting the notion. It adds complexity to Leveson's STAMP model or Reason's Swiss Cheese model in that the "layers of defense" in a small org might be fewer (less redundancy), which emphasizes management and culture as defenses - precisely what our Tier 1 and Tier 3 stress.

The framework also interacts with theory of organizational change management. In a tiny company, putting SMS into practice is basically a change process altering attitudes, priorities, and habits. Reflecting traditional change theories, our phased road map creates urgency and buy-in (management commitment phase), builds a guiding coalition (assigns roles), communicates rapid wins (fix hazards, celebrates reporting), consolidates gains (expands training, monitoring), and institutionalizes new practices (safety becomes ingrained). Our practical illustration of change management in a small business environment comes from clearly including a phased strategy and cultural components. This contributes to studies on how small businesses implement new management systems, which often emphasizes the need of simplicity and leadership-driven transformation (consistent with our findings).

Another theoretical consequence relates to the scalability of regulatory systems. Our research offers evidence to the idea that while scalability is possible, it is not inevitable. The FAA theoretically designed Part 5 to be scalable, but industry input and our case studies reveal that without clear scaled implementation models, small organizations suffer a gap. We essentially suggest a multi-tiered compliance system that could guide authorities: for example, regulators might think about a tiered SMS requirement whereby a 10-person shop must meet a subset of SMS expectations (levels 1-2) while a 100-person must meet full (level 4). This idea fits with risk-based oversight and proportional regulation—ideas in regulatory theory indicating requirements should be commensurate with the entity's size/risk. Our approach therefore not only provides companies with tools but also might be a model for regulatory advice on SMS for small certificate holders, therefore closing the gap between high-level criteria and real practice.

The study also emphasizes the universal relevance of management dedication and communication in safety results, independent of organizational size. This echoes decades of safety culture studies that regularly identify management dedication as the primary predictor of safety performance. In the small org setting, our research confirms this and shows how that

dedication may be seen in actual deeds rather than only in espoused beliefs. It strengthens the idea that safety management is basically a social process—about matching people's perceptions, behaviors, and interactions—and that technical tools or procedures will fail without that social basis.

Practical Implications

The suggested framework provides a road map for practitioners—owners, managers, and safety experts in the aviation maintenance field—to apply SMS in a practical manner. Using this framework, small Part 145 operators can begin preparing for future SMS requirements instead of waiting for rules to compel their action. Doing so helps them to proactively enhance safety and probably get efficiency or quality advantages (as certain studies indicate SMS can lower occurrences and hence expenses).

The framework offers practical actions and resources: for instance, management now has a checklist of what to do first (write a policy, set up reporting, etc.), and employees can understand what's expected of them (report hazards, participate in training). This clarifies SMS, therefore lessening its fear factor. The pilot implementation revealed that a small company's current personnel could complete these actions even with little outside assistance. Therefore, the framework may be viewed as a capacity-building tool: it enables small organizations to develop internal safety management capacity using little outside resources.

The framework can help auditors and authorities assess SMS in small organisations, which is another useful feature. Should FAA inspectors supervise a small repair station's SMS, they might refer to our matrix: is there proof of Tier 1 commitment? Is there a Tier 2 reporting log? etc. It offers a more complex assessment than a binary "SMS or no SMS." The framework could be included in training or member direction for industry associations such ARSA, NBAA, AEA. The ARSA could actually assist members in following the forthcoming SMS requirements under the bilateral agreement by using the matrix and roadmap in seminars.

Importantly, the framework is not aviation-specific in content; while it was designed for maintenance organizations, the concepts could apply to other small high-risk workplaces (e.g., small air traffic control units, ground handling companies, or even non-aviation sectors like small manufacturing plants). Ideas cross-pollination—such as using current quality systems as a springboard for SMS—can be embraced broadly. Its practical for resource-limited companies since it encourages integration instead of parallel systems.

One reasonable question some might ask is: do tiny businesses have time to accomplish all this? Our study indicates that after the system is operational, upkeep is not burdensome;

rather, it becomes normal. Filling out a hazard report, for instance, could take 5 minutes; checking the log could take 30 minutes each month—small investments for maybe avoiding accidents or expensive errors. The system reduces the time load by framing SMS activities as a natural component of labor rather than as distinct tasks. Furthermore, according to an expert, SMS might pay for itself if it can lower one expensive rework or incident. Practitioners should therefore see SMS as smart business practice rather than just compliance since it can enhance dependability, reputation, and even financial performance by preventing losses.

Limitations

Although this framework and research offer insightful analysis, there are certain restrictions to note:

General vs Specific: Our emphasis was on Part 145 small maintenance companies. All were inside the United States (with its particular regulatory and business environment), thus the sample size—six cases—is rather small. Thus, the framework is most directly relevant to comparable U.S. situations. Generalizing globally calls for caution; small organizations in other nations may encounter different difficulties (e.g., varying cultural attitudes toward authority could influence reporting culture). Much of the material is general, we think, but some tailoring could be required for local context since we included more extensive literature including international sources including CASA, ICAO, etc.

Variability in Implementation: The pilot test was successful partly because the company was eager and somewhat ready (they already had a quality system and a proactive manager). A business whose leadership is not convinced of SMS value may find the framework more contentious. Our research did not cover a "failed implementation" example to completely grasp challenges in that context. Future trials could identify roadblocks not experienced in our pilot, such as staff pushback or competing priorities under extreme business pressure. The system is therefore not a surefire recipe; it still calls for dedication and work, which not all companies could invest.

Because those are uncommon events and not practical to assess in short term or small samples, we mostly measured process and culture changes, not final safety outcomes like accident rates. A well-implemented SMS is assumed—based on more general research—to enhance safety results (fewer incidents, more hazard mitigation). We did observe leading indicators rise (reports, corrections performed). That would call for a long-term research with a bigger sample and control groups, thus we cannot scientifically assert that using this

framework will lower accidents by X% in small organisations. Thus, although logically anticipated, the efficacy in terms of real risk reduction still has to be measured.

Possible Bias in Case Studies: Like with any qualitative study, there is a possibility of prejudice. Results might be rather hopeful since the businesses that agreed to participate and particularly the one that piloted may be more safety-conscious than the average (self-selection bias). We attempted to offset this by adding some instances with no SMS interest to observe the unprocessed condition; those may have been less forthcoming. Furthermore, the researcher presence during pilot might have offered additional support even if we attempted to step back that a business operating alone would not have. Though some may require outside consulting or mentoring, the framework is meant for personal use. This might be a restriction if such support is lacking.

Scope of Content: We purposefully kept the framework basic and did not explore some advanced SMS ideas (for example, we discuss risk assessment qualitatively, but do not recommend particular risk matrices or analysis tools). Though it means our framework could miss certain finer aspects of SMS—like thorough data analysis or particular safety performance indicators that bigger organisations use—we did not want to overload small organisations. Some safety purists could claim it's a "light" SMS. A "light SMS" is, in our opinion, far better than none and probably appropriate for the risk setting. However, as small organisations develop, they could eventually have to include more complex techniques; our approach is a beginning point, not the final state for all.

Future Research

This work creates many avenues for more investigation:

Longitudinal Studies: Conducting longitudinal studies tracking several small businesses over time as they apply SMS (with or without this framework) to assess long-term effects on safety outcomes, operational performance, and even economic indicators would be beneficial. Such studies could confirm quantitatively the anecdotal advantages and verify sustainability of the practices.

Future studies could investigate creating digital tools or apps to help small businesses depending on this framework. A basic SMS mobile app for hazard reporting and tracking customised for small maintenance shops, for instance, could help to further lower the barrier. Research could put such tools to use.

Cross-Industry Comparison: Do the difficulties and solutions discovered here reflect those in small businesses in other sectors (e.g., healthcare clinics, small construction companies)? Comparative research could be conducted to determine whether this framework—or a variation—could serve as a general model for small business safety management systems outside aviation. That would help to clarify SMS scalability in high-risk industries.

Research might simulate or model the effect of required SMS on small Part 145 companies under new rules. Will using frameworks like ours to implement an SMS lower insurance costs or incident rates? Will it cause financial pressure? Data collection from early adopters versus those without SMS could help to clarify these issues. The findings might help authorities to change implementation times or offer assistance as required.

Organizational Psychology Aspects: It would be fascinating to investigate the human elements and cultural evolution in small businesses as they embrace SMS. Monitoring changes in safety culture climate scores or employee morale, for example, as SMS is put into place could provide insights. Does including workers in SMS raise their general involvement or job happiness? Some studies indicate that staff members value it when management demonstrates real concern for safety since it may help to build trust and retention.

Examining and recording times when SMS implementation in a small organization failed or stalled would be enlightening. We mostly observed positive or neutral situations; a thorough investigation into a negative case—maybe using post-mortem analysis if a small business lacked an SMS and suffered an accident—could reveal more obstacles or traps that require attention in the framework or future training.

Ultimately, this study offers a starting point in an area that, as our literature review revealed, has been under-addressed: scaling safety management for small entities. We wish it spurs both more academic attention and practical adoption by bridging theory and practice.

VII. Conclusion

Though historically they have not had the same degree of organized safety management as their bigger counterparts, small aviation maintenance companies create a vital link in the aviation safety chain. This paper found the resulting safety gap and offered a fix in the shape of a scalable SMS framework especially suited to the reality of these small U.S. Part 145 maintenance companies. By means of a multi-case study and in-depth interaction with industry professionals, we distilled the obstacles (financial, regulatory, technical, and cultural) hindering SMS implementation in small environments and more importantly, we derived feasible

solutions to overcome them—from leadership-driven culture change to streamlined reporting and training practices.

Any small maintenance provider can modify the suggested framework—encapsulating Leadership Commitment, Simplified Reporting, Integrated Training, and Progressive Monitoring. Ensuring that even the smallest 10-person shop can start with the fundamentals and expand its safety management capacity over time, it combines the universality of ICAO's SMS pillars with the flexibility of a tiered, stepwise approach. Expert agreement and a pilot application confirmed the framework, proving not only its theoretical validity but also its practical viability and efficacy in raising risk management and safety awareness on the shop floor.

Implementing this system allows small maintenance companies to proactively raise their safety performance by means of hazard identification before accidents, worker involvement in safety, and process constant improvement. Doing so helps them to safeguard their staff and clients, follow developing legal rules, and help to general aviation system safety. Even in the most active small repair shops, the framework guarantees that "safety is everyone's job" is not only a slogan but a daily reality.

This study fills a vital gap by offering a scalable route to SMS implementation, therefore enabling small aviation maintenance businesses to participate in systematic safety management with larger entities. Frameworks like this will be crucial to bring all players—big and small—to an equal level of safety assurance as the aviation sector moves toward SMS as a standard for all sectors. This work's importance goes beyond merely following rules; it enables small enterprises to create a more robust safety culture and operational resilience, therefore enabling them to avoid accidents and save lives. The writers urge regulators and industry players to embrace and promote such scalable SMS initiatives and to keep working to improve these instruments so that safety management really becomes scalable, practical, and universal across the aviation maintenance sector.

Reference

[1] Federal Aviation Administration (FAA). (2015). *Advisory Circular 120-92B: Safety Management Systems for Aviation Service Providers*. Washington, DC: FAA. faa.govfaa.gov

[2] Federal Aviation Administration (FAA). (2023). *Safety Management Systems (SMS) Final Rule*. [Docket No. FAA-2021-0419]. Washington, DC: FAA. faa.govfaa.gov

[3] International Civil Aviation Organization (ICAO). (2013). *Annex 19 – Safety Management (1st ed.)*. Montreal: ICAO. mdpi.commdpi.com

[4] Civil Aviation Safety Authority (CASA). (2022). *Safety Management Systems for Aviation: A Practical Guide – Book 7: Scaling for Size and Complexity*. Canberra: CASA. casa.gov.aucasa.gov.au

[5] Stroeve, S., Smeltink, J., & Kirwan, B. (2022). Assessing and Advancing Safety Management in Aviation. *Safety*, 8(2), 20. https://doi.org/10.3390/safety8020020 mdpi.commdpi.com

[6] Australian Transport Safety Bureau (ATSB). (2011). *A Systematic Review of the Effectiveness of Safety Management Systems*. ATSB Research Report XR-2011-002. Canberra: ATSB. atsb.gov.auatsb.gov.au

[7] Gerede, E. (2015). A qualitative study on the exploration of challenges to the implementation of the Safety Management System in aircraft maintenance organizations in Turkey. *Journal of Air Transport Management*, 47, 230-240. https://doi.org/10.1016/j.jairtraman.2015.06.006 ideas.repec.org

[8] Jaiswal, K., Al-Mahadin, A., & Verma, S. (2018). Safety culture in aircraft maintenance organizations of United Arab Emirates. *Proceedings of the 3rd European Conference on Safety Engineering*. researchgate.net

[9] National Air Transportation Association (NATA). (2023). Comment letter on FAA Notice of Proposed Rulemaking (SMS Expansion), Docket FAA-2021-0419. (Cited in FAA Final Rule preamble) faa.govfaa.gov

[10] Aircraft Repair Station Association (ARSA). (2024). U.S. Bilateral

[11] Aircraft Electronics Association (AEA). (2023). *SMS Tools for Repair Stations* (web resource). Retrieved from AEA website】

[12] National Business Aviation Association (NBAA). (2021). *NBAA Concerned About Upcoming SMS Regulations for Part 135 Operators* (Press Release). Washington, DC: NBAA】

[13] Lappalainen, J. (2017). Overcoming Obstacles to Implementing SMS. *International Transport Forum Discussion Paper 2017-18*. OECD/ITF, Paris】

[14] Skybrary. (2018). *SMS for Small Organizations* (Guidance article). SKYbrary Wiki.】

[15] Federal Aviation Administration (FAA). (2022). *Safety Management System Explained – Components*. FAA SMS Website】

Citation: Ayegba David Haruna, Olugbenga Olayinka Taiwo, Ridwan Adebowale Yusuf. (2024). Closing the Safety Gap: A Framework for Aviation Maintenance Organizations. International Journal of Aviation Management (IJAM), 2(2), 1-42.

Abstract Link: https://iaeme.com/Home/article_id/IJAM_02_02_001

Article Link:
https://iaeme.com/MasterAdmin/Journal_uploads/IJAM/VOLUME_2_ISSUE_2/IJAM_02_02_001.pdf

✉ **editor@iaeme.com**