



Analysis of Pathways to Achieving Civil Aviation Safety Culture and Management through the Voluntary Reporting System

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Abstract. This article discusses the beginning of VRS, original running analysis of VRS system and the relationship between VRS and civil aviation culture to support a realizing path advisement of a system of VRS of civil aviation promoting health safety culture.

Keywords: civil aviation; safety culture; VRS; management

1 Introduction

Voluntary Reporting System (abbreviation and hereafter, VRS) is one kind of behavior mechanism aims to encourage front-line practitioners (such as pilot, air traffic controller [ATCO], aircraft maintenance technician [AMT], security check, cabin crew and so on) to proactively report any safety hazards, man-made error, system defects and other kinds of abnormal events that encountered at work. It is an information collecting mechanism which is included in confidentiality, anonymity and non-punitive in nature, its fundamental purpose is concerned with drawing information, improvement system, instead of pursuing personal liability.

2 The Origination and Development of VRS

In 1976, Aviation Safety Reporting System (abbreviation, ASRS) has been conducted by National Aeronautics and Space Administration (abbreviation, NASA), which become the first operational VRS in formally all over the world.^[1] In view of the successful operation of VRS of ASRS, England, New Zealand, Canada, Australia and other countries have successively emulated to build national level VRS for themselves. Since its establishment, ASRS system has been providing a large amount of VRS data. The survey data indicated that ASRS system of USA received 108000 reports in 2019 alone and, as high as 431 pieces of VRS reports have been received per working day on average.

The “China Civil Aviation Voluntary Reporting” project, officially launched in September 2004, marked the formal establishment of China’s first national-level voluntary

reporting system. In view of data, for the entire country and year, VRS reports that have been received in 2024 were only 592 pieces, of which only 552 pieces were valid reports.

A multitude of genuine precursors and potential hazards have been reported proactively by employees, is going to enhance employees' sensitivity to safety hazards in their workplace, encouraging them to correct deficiencies actively that impact flight safety, cultivating employee responsibility and effectively and timely preventing a full spectrum of safety risks.

3 Operation Analysis of VRS

Now, in the case that SCASS's effective reports are insufficient caused by:

Firstly, the subjective reason is civil aviation employees' subjective perception and attitude. Some aviation employees lacked awareness on the importance of VRS and lacked the initiation and sense of responsibility to proactively report safety hazards, rather than assigned responsibilities. Also, some aviation employees had scruples, that once such reports were submitted will suffer any criticism or undertake responsibilities, furthermore, affecting private development thus choosing to conceal and not report. Besides, some aviation employees were worried about VRS confidentiality was not rigorous, which was classified information disclosure during self-reporting process, affecting their social relationships and personal reputation etc.at work.^[2]

Secondly, one of the subjective reasons for VRS of civil aviation is VRS service of existing shortage. Maybe inadequate training, or service platform itself exists overly complex, lengthy or, flaw system etc. such problems made employees feel troubles of familiarity with report processes and user-friendliness for operation, furthermore, affected their willingness to report, well the workflow complexity, not easily operating was going to lower employees' motivation for reporting. The second reason is VRS feedback deficiency. Any employee did not reflect information that indicated from VRS in time, part of them thought of the required actions were make-work. At the same time, individual leaders faced to aviation security issues only focused on mere formality and aimed for results and, the relevant policy "non-punitive" report were implemented inaccurately, all of which could affect the engagement of VRS.

4 Relationship between VRS and Civil Aviation Safety Culture

4.1 The Aviation Safety Culture

Aviation Safety Culture refers to the values, attitudes, beliefs, and practices commonly recognized and shared within civil aviation organizations, which determine how an organization commits to safety and how it behaves in response to risks.

The core elements of safety culture encompass five dimensions: first, safety perception at the leadership level—specifically, whether decision-makers prioritize safety over competing objectives; second, whether middle and senior managers as well as

frontline supervisors effectively bridge top-level strategy and frontline operations, rigorously enforce safety policies, and proactively address safety hazards. Third is employee participation, i.e., whether employees view safety as everyone's responsibility, proactively report hazards, suggest improvements, and voluntarily participate in safety training and drills. Fourth is accountability and responsibility, i.e., whether there are clear divisions of duties and fair accountability mechanisms, ensuring that everyone understands their specific safety responsibilities, while the organization provides a "non-punitive" reporting environment to encourage honest reporting of errors and hazards. Fifth is a learning organization with continuous improvement, i.e., learning from accidents, hazards, and daily operations to constantly optimize practices, share experiences, regularly review and update safety procedures and training content, among other measures. Among these, employee participation represents a bottom-up cultural atmosphere and is a distinctive component of safety culture. It serves as the lifeblood of a healthy safety culture, and its effectiveness directly influences the formation of a robust safety culture.^[3]

4.2 The Interplay Between the Voluntary Reporting System and Safety Culture

4.2.1. The Voluntary Reporting System as a "Barometer" and "Catalyst" of Safety Culture.

The quantity and quality of reports within a Voluntary Reporting System directly reflect the health of the safety culture. A system with a high volume and rich content of reports indicates that employees trust the organization and dare to speak up, which is a hallmark of a healthy safety culture. Conversely, if a reporting system exists in form only with no reports submitted, it may signify employee distrust in the organization, apathy towards the safety culture, or fear of consequences from voluntary reporting. Therefore, the Voluntary Reporting System acts as a "barometer" for civil aviation safety culture.

An effectively functioning Voluntary Reporting System itself continuously nurtures and strengthens safety culture. When employees see that the issues they report are taken seriously by management and lead to tangible improvements (e.g., procedure modifications, equipment updates, enhanced training), individuals receive strong positive reinforcement. This encourages greater participation in safety management, particularly at the frontline, creating a virtuous cycle of "report-improve-report again." Thus, the Voluntary Reporting System serves as a "catalyst" for the healthy development of safety culture.

4.2.2. Safety Culture as the Operating Environment and Foundational Guarantee for the Voluntary Reporting System.

The survival and successful development of a Voluntary Reporting System depend on whether the organization possesses a healthy and just cultural environment. A just culture provides the essential "psychological safety" environment for the reporting sys-

tem—ensuring that voluntary reporting carries no negative consequences for the reporter, a concern especially heightened in our interconnected age. Simultaneously, management commitment guarantees the long-term resource of the system. Management must demonstrate through concrete actions a commitment to establishing effective accountability mechanisms and strictly supporting the system's independent operation.^[4] This includes ensuring the confidentiality and anonymity of the Voluntary Reporting System and vigorously promoting improvement measures based on reported information. Without genuine support from leadership, favorable institutional guarantees, and a timely, effective feedback mechanism, the reporting system easily becomes a mere formality.

The Voluntary Reporting System and safety culture are not independent concepts but two sides of the same coin—a symbiotic and mutually reinforcing relationship. The Voluntary Reporting System is the concrete institutional embodiment and a key operational tool of safety culture, while a healthy safety culture is the essential soil and environment for the system's effective operation. Together, they form the foundation for the current strategic shift in civil aviation safety management from passively responding to accidents to proactively managing risks.

4.3 Pathways for the Voluntary Reporting System to Promote Healthy Safety Culture and Management

4.3.1. To Optimize Reporting Formats and Methods, Simplify the Reporting Process.

With the emergence of various internet applications, the Voluntary Reporting System can leverage software commonly used by employees to simplify the reporting process. Enabling reports through convenient channels (online forms, official accounts, mini-programs, phone hotlines, etc.) minimizes procedural complexity, lowers the reporting threshold, shortens reporting time, and ultimately increases report volume.

4.3.2. To Clarify "Non-Punitive" Reporting and Enhance Awareness Campaigns.

Develop and widely publicize clear policies that distinctly differentiate between human error, unintentional unsafe acts, and willful violations. Ensure the system's fairness to win employee trust. Prevent situations where employees withhold reports due to fear of excessive accountability for human error or unintentional unsafe acts, as this can lead to more significant safety hazards. Only by providing a non-punitive reporting environment within a clear framework of accountability and responsibility can the Voluntary Reporting System operate efficiently.

4.3.3. To Uphold Confidentiality and Anonymity to Ensure Independent Operation.

The fundamental purpose of a Voluntary Reporting System inherently includes characteristics of anonymity and confidentiality. Anonymity safeguards the identity of the reporting employee, ensuring greater authenticity and credibility of the report content.

Confidentiality protects the employee's interpersonal relationships and career development from being affected by the report. Therefore, system design must guarantee absolute security, and its operation must strictly adhere to confidentiality principles.^[5] The system should be operated by an independent third party (or a highly autonomous internal department) to ensure, both technically and legally, the confidentiality of report sources and the anonymity of reporters.^[6]

4.3.4. To Provide Timely Incentives and Feedback for Voluntary Reports.

If employees receive no immediate or delayed feedback after submitting a report, they may perceive their action as useless. Therefore, it is necessary to strengthen the platform's capabilities. For reports submitted via convenient channels like online forms, official accounts, or mini-programs, consider providing appropriate material rewards immediately to serve as an incentive.

4.3.5. To Build a Closed-Loop Management Cycle to Foster Safety Culture Awareness.

Civil aviation organizations should establish a "report-analysis-feedback-improvement" closed-loop management cycle based on information from the Voluntary Reporting System. Leadership must reinforce safety awareness, prioritize safety in decision-making, and ensure timely handling of reports. At the operational level, expert teams should conduct in-depth analysis of reports to uncover underlying systemic causes (e.g., process design, inadequate training, resource allocation, corporate culture). Analysis results should be translated into concrete improvement measures (revising manuals, issuing safety alerts, enhancing specific training, etc.). Middle management and frontline supervisors must then widely communicate these improvements and outcomes back to frontline staff. This step is crucial for maintaining reporting motivation, making employees feel heard, valued, and that their input makes a difference, thereby fostering a bottom-up safety culture atmosphere and cultivating organization-wide safety awareness.

4.3.6. To Implement Delayed Incentives within the Voluntary Reporting System.

Following the aforementioned "report-analysis-feedback-improvement" measures, the lessons learned from reports should be shared across the entire industry through various channels (safety newsletters, case studies, training courses) to maximize their value and prevent similar incidents from recurring in different companies. Additionally, alongside formal procedures, recognizing and rewarding reporting employees based on the significance of their contributions to acknowledge the preventive value of their information. Use both formal documentation and informal communication to guide and encourage voluntary reporting behavior among other employees.

5 Conclusion

The relationship between the Voluntary Reporting System and safety culture is akin to that between blood and the circulatory system. Having only the form of a safety culture without a Voluntary Reporting System is like having blood vessels devoid of blood—an empty shell that eventually withers from lack of nourishment. Having only a Voluntary Reporting System without cultivating safety culture is like blood flowing through damaged vessels—lacking propulsion and direction, it cannot deliver nutrients effectively, spills out, and loses its value.

In summary, for China's civil aviation to achieve the leap to a higher level of safety through "self-management," is essential: On one hand, continuous investment in funds, technology, and management is needed to technically refine the Voluntary Reporting System. On the other hand, persistent efforts in safety culture development are required.

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