



Best In Class – FOD Prevention Guidance: NAS 412

A Holistic Approach to Risk Mitigation for the
Aerospace and Defense Industry





PREFACE

Founded in 1919 with roots going back to the Wright Brothers, the Aerospace Industries Association (AIA) is the nation's pre-eminent association of manufacturers and suppliers of civil, military and business aircraft, helicopters, unmanned aircraft systems, space systems, aircraft engines, missiles, and related components, equipment, services and information technology. AIA advocates for policies and responsible budgets that keep our country strong, bolster our capacity to innovate and spur our economic growth.

This white paper presents AIA's views on Foreign Object Damage (FOD) risk mitigation practices and emphasizes the importance of updating AIA's National Aerospace Standard (NAS) 412, last revised in September 2013, which provides the reader "with clear and precise, practical information on Foreign Objects (FO) and Foreign Object Debris (FOD) detection and elimination to help create a climate of Foreign Object Damage (FOD) Prevention." An update of the standard is needed to keep pace with technology change, to clarify FOD concepts and requirements, to improve guidance for tool control methods, and to enhance the user community to include global suppliers. This standard is the benchmark guidance material for all facets of

aerospace and defense industry products being designed, developed, manufactured, assembled, operated, repaired, modified, refurbished and maintained, and as such, is vital to our industry's performance. Indeed, there is no FOD prevention guidance material that provides a holistic approach for achieving a successful FOD prevention program better than the Standard. NAS 412's role in FOD prevention is critical to the avoidance of manufacturing mishaps, ensuring the reliability of products, and the safety of flight. Also, NAS 412 helps create value for our member companies by providing common guidance on how to eliminate a root cause of avoidable expenditures and to enhance workplace safety.

The need to keep NAS 412 current in the face of more complex demands on aerospace and defense companies seeking to prevent Foreign Object Damage is in alignment with AIA's 2017 goal of reinforcing collaborative approaches for government and industry to promote mutual understanding and eliminate burdensome regulations. Revising NAS 412 will reinforce AIA's emphasis on ensuring the American aerospace and defense industry is a positive force for innovation, and on renewing American leadership in global trade.

EXECUTIVE SUMMARY

Since the release of National Aerospace Standard 412, aerospace and defense companies have faced new challenges in their execution of Foreign Object Damage Prevention Programs. To ensure National Aerospace Standard 412 is up to date, AIA's NAS 412 Subcommittee, a subset of the Quality Assurance Committee, has concluded that AIA should revise it to meet industry needs with the following changes:

- **The Standard should enhance and clarify definitions used in other industry requirements.**
- **The Standard should revise the Tool Management section to focus on tool accountability processes.**
- **The Standard should expand the user base by inviting global partners to participate.**



INTRODUCTION

In October 2015, AIA's NAS 412 Subcommittee, comprised of Foreign Object Damage Prevention Subject Matter Experts (37 participants from 16 AIA member companies) met in Fort Worth, Texas. On the agenda was a discussion of how innovative practices and technological advancements in the aerospace and defense industry and across all industry sectors can be applied to ongoing and new aerospace and defense activities. The attendees determined that NAS 412 is still widely used as an effective guide to mitigate, enhance, eliminate, and promote aerospace safety and the preservation of private and national assets. But they also determined it should be updated to reflect recent technology developments. This paper addresses the importance of revising the Standard and maintaining a concurrent industry guidance as a forum to compile and share solutions for preventing FOD. A concurrent Industry Standard will allow the user to grow in knowledge and keep pace with new inspection challenges and develop new detection and elimination technologies. It will also provide users the opportunity to share best practices.

ISSUES FOR PRACTITIONERS, OPPORTUNITIES FOR INDUSTRY

Justification for an Update of NAS 412

The overarching goal of NAS 412 is to ensure the entire supply chain, from raw material, to component, to subassembly, to return merchandise authorization (RMA), to line replaceable unit (LRU), to system level integration applies robust FOD risk mitigation practices. This can only occur if the user has access to a guidance Standard that remains concurrent with recent technological advances. In a survey, forum attendees identified the following areas to focus on with the next revision:

Current State	Necessary Changes
Definitions section contains terminology that is outdated or is unclear to the user.	Section needs to be refreshed with updated terminology for clarity.
Tool Management section has language confusing to the user.	Section needs to be updated to clarify Tool Management from Tool Control.
There is a lack of international input to the current standard.	Seek international input to gain insight and expand the user group.



Opportunities to enhance the Definitions section

What is FOD? Different sources such as the Internet, company policies, and consultants often provide NAS 412 users with different answers to this basic question. This causes confusion, leaving users perplexed on how to assess FOD risks and place control measures for foreign object elimination. The user community will benefit from standard terminology definitions for Foreign Objects / Foreign Object Debris / Foreign Object Damage. Yet to achieve that standard and ensure NAS 412 remains the premier standard guidance for FOD Prevention, further language revision to clarify the definition of FOD is necessary. These language changes will enable users to assess the risk of potential damage within their operations and to focus resources effectively on building a successful FOD Prevention Program. The Standard can be the authority to clarify the progression of how Foreign Objects (FO) become Foreign Object Debris (FOD) ending in Foreign Object Damage (FOD). By doing so, the entire supply chain benefits from a credible and uniform source for information about the elements of a successful FOD Prevention program. Additionally, reviewing the current definition will allow the user community to grow from a global standpoint, as the industry supply chain grows and shares their interpretation of the Standard with international users.

Opportunities to enhance the Tool Management section

As both regulations/requirements for addressing tool management (inventory) as well as tool control (accountability) can be costly to implement, users must have clear guidance on the concepts and requirements of both aligned with industry practices. There is no definitive guidance that explains a logical approach to total tool management. Standard 412 will be improved by updating the current language and clarifying the requirements/logic to align with industry expectations. A better understanding of tool management concepts will improve guidance for tool control methods and reduces risk of tool FOD.

Opportunities to enhance the user community

FOD Prevention is a global requirement, yet there is no forum for FOD Subject Matter Experts (SMEs) in the U.S. and abroad to converse and share their challenges, experiences and best practices. An updated NAS 412 should include inputs from SME's representing international companies so that both U.S. and international companies will benefit from FOD Prevention shared practices and strategies. Revising NAS 412 will provide the opportunity to develop a comprehensive "How-To" document that supports the implementation of published standards from other organizations like the International Aerospace Quality Group (IAQG). NAS 412 Standard will promote this type of communication by including global companies in the revision process.

CONCLUSIONS AND RECOMMENDATIONS

Revision Justification

NAS 412 should be revised to address current user needs for both small suppliers and established OEMs, and to develop opportunities to introduce new users to the Standard. A revision will sustain NAS 412 as the premier guidance for global application in FOD Prevention. This document is often the introduction to FOD Prevention for users. Many companies make their own processes and procedures for contractual needs based on the use of the Standard. Keeping the revision process informative instead of too prescriptive will allow the Standard to be tailored by users to best fit their FOD Prevention program. As earlier noted, there is no FOD Prevention guidance material that provides a holistic approach for achieving a successful FOD prevention program better than the Standard.

A revised NAS 412 Standard will provide a benchmark resource at the forefront of FOD Prevention guidance for the user that will be relevant, innovative, and executable based on the following criteria:

- Is FOD risk mitigation imperative for the A&D industry or other emerging industries?
- Does the Standard assist and support safety of flight/deployment mitigation practices to avoid the potential for loss of life?
- Does the Standard impact military readiness and mission success?
- Are increased operation maintenance and sustainment costs still impacted by FOD?
- Can lost revenue/penalization be potentially avoided by application of the Standard because of FOD (monetary value of audits, evaluation of the problem, corrective actions, etc.)?
- Does the Standard adequately address new manufacturing technologies/emerging industries introducing new FOD risk challenges?

ACKNOWLEDGMENTS



The authors of this whitepaper would like to thank the AIA Quality Assurance Committee (QAC) for sponsoring the effort and providing essential reviewing support by its member companies, as well as the AIA Technical Operations Committee (TOC) for approving these underlying best in class strategy.

Special thanks goes to Gery Mras for lending his support as the AIA QAC Life Cycle Director and providing valuable insights into the works of other association efforts in the DoD and government customer spaces.

The authors also recognize the valuable strategic insights and leadership guidance from the Chair and Vice-Chair of the QAC, James Bratton (Lockheed Martin Corporation) and Mary D'Ordine (Ball Aerospace and Technologies Corp.), respectively.

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