ASME MUS-1–2024

Use of Unmanned Aircraft Systems (UAS) for Inspections

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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FOREWORD

The use of unmanned aircraft systems (UAS) has become increasingly popular in various industries. The energy, manufacturing, medical, and public safety industries have demonstrated how UAS have positively impacted their businesses by improving personnel safety and boosting efficiency. The inspection and maintenance sectors have also benefited from implementing UAS programs to perform inspections and repairs of infrastructure to replace conventional methods.

UAS will continue to provide more opportunities.

It is recognized that the Federal Aviation Administration (FAA) is the governing body to fly outdoors; however, there is no governing body to fly UAS indoors. This Standard aims to cover flying under the FAA as well as provide more guidance to those who fly indoors.

The ASME Mobile Unmanned Systems (MUS) Standards Committee was formed in 2019 and oversees three subcommittees: Unmanned Aircraft Systems/Unmanned Aircraft Vehicle for Inspection, Crawlers/Ground Robotics for Inspection, and Remotely Operated Vehicles/Autonomous Underwater Vehicles for Inspection.

This Standard is available for public review on a continuing basis. Public review provides an opportunity for additional input from industry, academia, regulatory agencies, and the public-at-large.

ASME MUS-1–2024 was approved by the American National Standards Institute as an American National Standard on May 8, 2024.

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Revisions and Errata. The committee processes revisions to this Standard on a periodic basis to incorporate changes that appear necessary or desirable as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published in the next edition of the Standard.

In addition, the committee may post errata on the committee web page. Errata become effective on the date posted. Users can register on the committee web page to receive e-mail notifications of posted errata.

This Standard is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number, the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

Cases

(a) The most common applications for cases are

(1) to permit early implementation of a revision based on an urgent need

(2) to provide alternative requirements

(3) to allow users to gain experience with alternative or potential additional requirements prior to incorporation directly into the Standard

(4) to permit the use of a new material or process

(b) Users are cautioned that not all jurisdictions or owners automatically accept cases. Cases are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or owners to choose any method of design or any form of construction that conforms to the Standard.

(c) A proposed case shall be written as a question and reply in the same format as existing cases. The proposal shall also include the following information:

(1) a statement of need and background information

(2) the urgency of the case (e.g., the case concerns a project that is underway or imminent)

(3) the Standard and the paragraph, figure, or table number

(4) the editions of the Standard to which the proposed case applies

(d) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Approved cases are posted on the committee web page.

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ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard requirements. If, based on the information submitted, it is the opinion of the committee that the inquirer should seek assistance, the request will be returned with the recommendation that such assistance be obtained. Inquirers can track the status of their requests at https://go.asme.org/Interpretations.

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Interpretations are published in the ASME Interpretations Database at https://go.asme.org/Interpretations as they are issued.

Committee Meetings. The MUS Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the committee. Information on future committee meetings can be found on the committee web page at https://go.asme.org/MUScommittee.

USE OF UNMANNED AIRCRAFT SYSTEMS (UAS) FOR INSPECTIONS

1 INTRODUCTION

Unmanned Aircraft Systems (UAS) offer the potential to mitigate risks associated with manned inspection techniques and improve efficiency and viability. The use of these systems for inspections of infrastructure has become popular; however, the methods of performing these inspections using UAS have not been defined. Figure 1-1 demonstrates the different aspects of conducting an inspection using UAS for the purpose of obtaining quality data and maintaining safety within the inspection environment.

The intent of this Standard is to encompass operation and safety of not only the vehicle but the whole system. It is the goal of the UAS for Inspection Subcommittee to address operation of UAS using other nondestructive examination (NDE) methods.

NOTE: Throughout this Standard, "UAS" refers to all essential elements associated with the unmanned aircraft system, including but not limited to the pilot, control station, aircraft vehicle, command and control datalink, launch and recovery equipment, etc., whereas "UA" refers to the unmanned aircraft only.

1-1 Scope

This Standard provides the requirements for the use of UAS to safely and reliably perform inspections to obtain quality data and repeatable results. It is the responsibility of the user of this Standard to determine whether using UAS to perform the inspection is the proper method for the desired outcome. The vehicles used for the inspection of assets may involve rotary, vertical take-off and landing (VTOL), fixed winged, or hybrid platforms. In some conditions, the use of a tethered system is recommended.

This Standard was written to be used by many industries and not only comply with ASME code-related inspections. The use of this Standard provides the basis of using UAS safely and reliably when carrying out inspections and can be applied to the inspection.

Figure 1-1-1 shows the different inputs the Standard incorporates toward the goal of providing high-quality, repeatable inspection results while encompassing best safety practices.

This Standard provides guidelines for the following:

(a) Outdoor Inspections. The jurisdictional authority applies to performing outdoor inspections. The owner operator can use this Standard in conjunction with applicable regulatory and industry operational and inspection standards [i.e., beyond visual line of site (BVLOS), detect and avoid, etc.].

(b) Indoor Inspections. The jurisdictional authority typically does not apply to indoor inspections. The operator can use this Standard to perform inspections to apply applicable codes or standards for obstructed/unobstructed examinations.

The best practices, procedures, and equipment are dependent on which type of inspection is being conducted. Figure 1-1-2 illustrates the overview of the ASME MUS-1 structure and applicability based on the different environments for conducting the inspection (i.e., indoor and outdoor).

1-2 Definitions

abuse: any form of explicit or implicit treatment that damages the integrity of the unmanned aircraft system (e.g., operation in adverse weather conditions).

airworthiness: the condition in which the unmanned aircraft system conforms to its certification type and is ready for safe operation.

autonomous: the ability or behavior of a robotic system to operate within its environment by implementing predetermined decisions or plans with no additional input from the pilot. Not controlled by others or outside forces; independent judgement.

auxiliary lighting: an artificial light source used as a visual aid to improve viewing conditions and visual perception.