Unmanned Aircraft Systems (UAS) used in Inspection, Testing, Maintenance and Load-Handling Operations
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Draft Revisions

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FOREWORD

This American National Standard, Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings, has been developed under the procedures accredited by the American National Standards Institute (ANSI). This Standard had its beginning in December 1916 when an eight-page “Code of Safety Standards for Cranes,” prepared by the American Society of Mechanical Engineers (ASME) Committee on the Protection of Industrial Workers, was presented at the annual meeting of the ASME.

Meetings and discussions regarding safety on cranes, derricks, and hoists were held from 1920 to 1925, involving the ASME Safety Code Correlating Committee, the Association of Iron and Steel Electrical Engineers, the American Museum of Safety, the American Engineering Standards Committee (AESC) [later changed to American Standards Association (ASA)], then to the United States of America Standards Institute (USASI), and finally to ANSI, Department of Labor — State of New Jersey, Department of Labor and Industry — State of Pennsylvania, and the Locomotive Crane Manufacturers Association. On June 11, 1925, AESC approved the ASME Safety Code Correlating Committee’s recommendation and authorized the project with the U.S. Department of the Navy, Bureau of Yards and Docks, and ASME as sponsors.

In March 1926, invitations were issued to 50 organizations to appoint representatives to a Sectional Committee. The call for organization of this Sectional Committee was sent out October 2, 1926, and the Committee was organized on November 4, 1926, with 57 members representing 29 national organizations.

Commencing June 1, 1927, and using the eight-page Code published by ASME in 1916 as a basis, the Sectional Committee developed the “Safety Code for Cranes, Derricks, and Hoists.” The early drafts of this safety code included requirements for jacks, but due to inputs and comments on those drafts, the Sectional Committee decided in 1938 to make the requirements for jacks a separate code. In January 1943, ASA B30.2-1943 was published, addressing a multitude of equipment types, and in August 1943, ASA B30.1-1943 was published, addressing only jacks. Both documents were reaffirmed in 1952 and widely accepted as safety standards.

Due to changes in design, advancement in techniques, and general interest of labor and industry in safety, the Sectional Committee, under the joint sponsorship of ASME and the Bureau of Yards and Docks (now the Naval Facilities Engineering Command), was reorganized on January 31, 1962, with 39 members representing 27 national organizations. The new Committee changed the format of ASA B30.2-1943 so that the multitude of equipment types it addressed could be published in separate volumes that could completely cover the construction, installation, inspection, testing, maintenance, and operation of each type of equipment that was included in the scope of ASA B30.2. This format change resulted in B30.3, B30.5, B30.6, B30.11 and B30.16 being initially published as “Revisions” of B30.2 with the remainder of the B30 volumes being published as totally new volumes. ASA changed its name to USASI in 1966 and to ANSI in 1969, which resulted in B30 volumes from 1943 to 1968 being designated as either ASA B30, USAS B30, or ANSI B30, depending on their date of publication. In 1982, the Committee was reorganized as an Accredited Organization Committee operating under procedures developed by ASME and accredited by ANSI.

This Standard presents a coordinated set of rules that may serve as a guide to government and other regulatory bodies and municipal authorities responsible for the guarding and inspection of the equipment falling within its scope. The suggestions leading to accident prevention are given both as mandatory and advisory provisions; compliance with both types may be required by employers of their employees. In case of practical difficulties, new developments, or unnecessary hardship, the administrative or regulatory authority may grant variances from the literal requirements or permit the use of other devices or methods, but only when it is clearly evident that an equivalent degree of protection is thereby secured. To secure uniform application and interpretation of this Standard, administrative or regulatory authorities are urged to consult the B30 Committee, in accordance with the format described in Section IX of the B30 Standard Introduction, before rendering decisions on disputed points.

Safety codes and standards are intended to enhance public safety. Revisions result from committee consideration of factors such as technological advances, new data, and changing environmental and industry needs. Revisions do not imply that previous editions were inadequate.

ASME B30.32 is a new Volume which incorporates a comprehensive and standardized safe approach for the use of UAS in load handling equipment inspection, testing, maintenance, and load handling operations. This first B30.32 Volume contains four chapters that covers definitions, personnel, documentation, UAS characteristics, inspection, testing, Maintenance and load-handling operations, preparations and practices. It is intended to be used in all industries and environments in which other B30 equipment within its scope are used and sets forth the requirements and recommendations addressing the recognized hazards that may be present when UAS are used.

This Volume of the Standard, which was approved by the B30 Committee and by ASME, was approved by ANSI and designated as an American National Standard on TBD.
ASME B30.32
“Unmanned Aircraft Systems (UAS) used in Inspection, Testing, Maintenance and Load Handling Operations”

CHAPTER 32-0
SCOPE, DEFINITIONS, PERSONNEL COMPETENCE, AND DOCUMENTATION

SECTION 32-0.1: SCOPE of B30.32

B30.32 includes provisions that apply to the use of unmanned aircraft systems (UAS) to support the inspection, testing, maintenance, and load handling operations of equipment addressed in other B30-series standards, except for B30.12.

SECTION 32-0.2: DEFINITIONS

aircraft: a device that is used or intended to be used for flight in the air.

first person-view (FPV): a mode of UAS operation where the Remote Pilot in Command monitors the unmanned aircraft vehicle (UAV) position through a camera installed on the UAV.

impact tolerant: a UAV design characteristic that allows any part of the UAV structure to be impacted during planned normal flight operations and not adversely affect its capability to continue flight operations. (see Figure 32-0.2-3)

inertial measurement unit (IMU): an electronic device that measures and reports a body's specific force, angular rate, and sometimes the orientation of the body, using a combination of accelerometers and gyroscopes.

lift director: a person that directly oversees the work being performed by other B30 equipment and its associated personnel and is the person responsible for all non-UAS equipment operations.

load handling operation: the operations that support other B30 equipment in the performance of their operations.

low altitude authorization and notification capability (LAANC): the collaboration between the Federal Aviation Administration (FAA) and the public that directly supports UAS integration into the airspace by providing UAV pilots with access to controlled airspace at or below 400 feet (122 m) as well as the awareness of where UAV’s can and cannot fly and Air Traffic Professionals with visibility into where and when UAVs are operating.

normal flight operation: the flight of a UAV that is properly performing within the UAS manufacturer’s flight guidance that addresses environment and performance.

payload: any weight lifted by a UAV that is attached to the UAV at locations authorized by the UAV manufacturer; does not violate the UAV manufacturer’s established weight and balance limits and uses attachment means provided or authorized for use by the UAV manufacturer or a qualified person.

qualified person: a person who, by possession of a recognized degree in an applicable field or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work and has the requisite information and skills necessary to evaluate the suitability of a device, component, or information for use with a UAS.

remote pilot in command (RPIC): a competent and appropriately licensed person with the combination of skills and knowledge required to perform the tasks defined in this standard who is responsible for all aspects of the UAS operation.

shall: a word indicating a requirement.

should: a word indicating a recommendation.

site owner: a person with the authority to speak for the entity controlling the site over which flight operations will take place.

support personnel: the person(s) designated to assist in the preparation and/or accomplishment of a UAS flight operation and the other B30 equipment.
testing: the operations that provide information regarding an operational characteristic.

UAS operator: a competent person who is appropriately licensed and directly inputs the commands that manipulate the movement of an unmanned aircraft vehicle.

UAS manufacturer: the entity that integrated the unmanned aircraft vehicle with its control systems and accessories.

UAV manufacturer: the entity that manufactured the unmanned aircraft vehicle.

unmanned aircraft systems (UAS): a system consisting of a powered unmanned aerial vehicle and equipment, apparatus, appurtenance, software, and accessories that are operated, or designed to be operated without a person on board and uses aerodynamic forces to provide aerial vehicle lift.

unmanned aircraft vehicle (UAV): the aerial vehicle that is flown as part of a UAS and sometimes identified as a “UAV”, “drone” or “quadcopter”. (see Figs. 32-0.2-1, 32-0.2.1-2 and 32-0.2-3)

visual line of sight (VLOS): a type of operation in which the UAS operator, or with the assistance of a visual observer, can maintain continuous unobstructed and mechanically unaided visual contact with the UAV in the performance of the UAS’s planned operations.

visual observer: a designated person(s) who, by visual observation of the UAV, assists the UAS operator in conducting the flight.
Figure 32-0.2-1 - Typical UAV Components

Figure 32-0.2-2 - Typical “Impact Tolerant” UAV Configurations
SECTION 32-0.3: PERSONNEL COMPETENCE

Persons performing the tasks or functions identified in this standard shall meet the qualifying criteria stated in the applicable B30 standards and shall, through education, training, experience, skill, and physical fitness, be competent and capable to perform the tasks and functions associated with UAS operations, as presented in this standard, and required by their employer or employer’s representative.

SECTION 32-0.4: DOCUMENTATION

32-0.4.1 General Information

(a) The UAS manufacturer, or UAS component manufacturer shall furnish with each UAS or component, documentation that includes information applicable to the UAS’ operation, inspection, testing, maintenance, components, and wiring diagram(s).

(b) The UAS manufacturer’s documentation shall at least provide:
   (1) Definition of the UAS’ inspection, testing and maintenance criteria and requirements to include their frequency.
   (2) Definition of the required and recommended pre-flight requirements regarding the accomplishment of inspections of the UAS, UAV, batteries, and supplied sensors.
   (3) Recommendations that include how to:
      (-a) Validate that the expected weather is suitable for UAV flight.
      (-b) Assign and indoctrinate UAS support personnel.
      (-c) Verify that the UAS registration is valid.
      (-d) Determine what UAS manufacturer’s documentation is provided.

(c) The UAS manufacturer’s documentation shall be provided in a language specified by the UAS purchaser at the time of the initial sale by the manufacturer.

(d) Pictograms used to identify controls shall be described in the instructions. The pictograms should comply with applicable industry recognized sources.

32-0.4.2 Translation of technical and safety-related instructions and manuals

(a) The entities responsible for the operation, use, inspection, testing, maintenance, assembly, and disassembly of the UAS shall have the technical and safety-related information available in a language that their employees can read and understand. If the information is not available in a language understood by their employees, the entities shall obtain a translation of the original UAS manufacturer’s technical and safety related information from the UAS manufacturer or from a translation service provider.

(b) Translations of the original language instructions (if the UAS manufacturer no longer exists or if the required language is not available from the manufacturer, translation of the instructions with the machine is acceptable) shall meet professional translation industry standards, which include, but are not limited to, the following:
   (1) translating the complete paragraph message, instead of word by word
   (2) ensuring grammatical accuracy
   (3) preserving the source document content without omitting or expanding the text
   (4) translating the terminology accurately
   (5) reflecting the level of sophistication of the original document

(c) The finished translation shall be verified for compliance with paragraphs (b)(1) through (b)(5) by a qualified person understanding the technical content of the subject matter.
CHAPTER 32-1
UAS CHARACTERISTICS

SECTION 32-1.1: POWERED FLIGHT CONFIGURATION

(a) The UAS characteristics shall meet or exceed the criteria established by the applicable regulatory bodies.
(b) The UAS manufacturer shall designate the UAV’s maximum rated speed for each powered flight configuration authorized by them for the UAS.
   (1) The UAV maximum rated speed when carrying a payload, shall be no more than 100 mph (161 km/h).
(c) The UAV shall maintain a neutral-pitch attitude when all flight controls are in their neutral position.
(d) The UAV shall have the capability to send video images to the UAS Controls.
(e) A global positioning system (GPS) shall be installed on UAV’s designed to be operated outside of enclosed spaces.

SECTION 32-1.2: UAV BODY

32-1.2.1 Configuration

(a) The UAV body shall be suitable to operate in the environments specified by the UAS manufacturer.
(b) The UAV manufacturer shall have at least considered the issues of water, dust, and adverse weather in establishing the UAV’s allowable operation conditions and configurations.
(c) The UAV manufacturer should provide lighting that will allow the UAV to be visually followed during flight.
(d) UAV propellers shall be protected as defined in 32-1.2.2.
(e) The UAV body shall have visual indicators that allow its front, rear, sides, and orientation to be visually identified during flights in the UAS manufacturer’s specified flight environments.
(f) The UAV shall have installed, or be capable of being retrofitted with, an in-flight identification system that meets the requirements of the applicable regulatory bodies.

32-1.2.2 Structure

(a) UAVs designated as impact tolerant do not require propeller guards but shall be able to withstand in-flight impacts to its structure or payload by a fixed object, without loss of controlled flight, and when flying at a speed that is not less than 20% of the UAV manufacturer’s designated maximum rated speed.
(b) UAVs not designated as impact tolerant shall have propeller guards installed which are:
   (1) designed for use on the UAV.
   (2) able to withstand in-flight impacts with a fixed object, without loss of controlled flight, when flying at a speed that is not less than 20% of the UAV manufacturer’s designated maximum rated speed.

SECTION 32-1.3: CONTROLS

32-1.3.1 General

(a) Modifications to the UAS manufacturer’s control system shall not be made without the written approval of the UAS manufacturer, or a qualified person.
   (1) The controls shall have the capability to be attached to the UAS operator’s person by harness, clips, or other methods.
(b) The controls shall use the radio frequencies allowed by the regulatory body that controls the communication frequencies allowed at the flight location.
(e) Programable UAV flight characteristics shall be provided for flight operations that:
   (1) Automatically activate upon loss of signal and / or insufficient UAS or UAV power.
   (2) Have the capability of returning to a designated landing location using a programmed flight altitude.
(3) Have the capability to adjust the video frequency used between the controls and the UAV (e.g., to reduce interference from local transmission sources.)

(4) Have the capability of automatically landing the UAV upon the loss of control signal or insufficient UAS flight power.

(d) Programable flight characteristics should be provided for flight operations that have the capability to adjust its control frequency (e.g., to reduce interference from local transmission sources.)

(e) A global positioning system (GPS) shall be installed on UAS systems designed to be operated outside of enclosed spaces.

1) When a GPS is enabled it shall have the capability to locate the UAV in a radius of less than 20 feet (6 m), in any direction.

2) When enabled it should provide input to the UAS control software to enable the UAV to maintain its attitude and position, in both vertical and horizontal planes.

(f) The controls shall be capable of controlling flight operations to within the height and distance limitations established by the UAS manufacturer.

(g) Anti-collision and proximity location control systems should be installed and:

1) Be capable of providing visual or audible warnings when specified parameters are met.

2) Be capable of being turned off.

3) Be capable of being tested for satisfactory operation, prior to flight operations.

32-1.3.2 Software

(a) Control software shall:

1) Provide a capability to present information on aircraft flight proximity.

2) Provide warnings regarding controlled airspace(s).

3) Have the capability to be programed for an allowable flight distance from the UAS Operator.

4) Have the capability, when GPS is enabled and the UAS controls are released, to maintain the UAV’s attitude, altitude, and horizontal position.

32-1.3.3 Flight information displays

(a) Shall be provided and:

1) Shall indicate when the control signal for the UAV is lost.

2) Shall indicate the UAV operating altitude.

3) Shall have a visual and / or audible indicator that displays the status of the UAS batteries in terms of remaining UAV flight time.

4) Should provide:

   (-a) Legible indication as to the status of the UAS’ operating parameters and settings, as defined by the UAS manufacturer.

   (-b) Legible display through FPV or through installed sensors.

   (-c) Compatibility with 3rd Party software applications used by the UAS.

   (-d) The capability to display aircraft warnings relevant to the UAS operating area.

   (-e) The capability to display airspace warnings relevant to the UAS operating area.

   (-f) The calibration status of installed flight control sensors.

   (-g) The calibration status of the IMU.

CHAPTER 32-2
UAS USED IN INSPECTION, TESTING, MAINTENANCE AND LOAD HANDLING OPERATIONS
SECTION 32-2.1 Suitable Inspecting, Testing, Maintenance, and Load Handling Operations

32-2.1.1 Inspection

(a) Thermal and acoustic emissions (e.g., brakes, clutches, motors, engines, wiring).

(b) Mechanical conditions (e.g., wear, damage, attachment, ropes, sheaves, slings).

(c) Component configurations (e.g., rigging position, clearances).
(d) Structural conditions (e.g., oxidation, cracking, coating failure, deformation).
(e) Non-contact measurements (e.g., Ultrasonic, infrared).

32-2.1.2 Testing
(a) Function operation monitoring (e.g., sheaves, guides, drums, ropes, switches, rods, linkages)

32-2.1.3 Maintenance
(a) Lubrication application verification (e.g., pins, bearings, reservoirs, gears)
(b) Fluid reservoir content verification (e.g., brakes, antifreeze)

32-2.1.4 Load Handling Operations
(a) Clearance Monitoring (e.g., designated signal person aid).
(b) Other B30 equipment load location verification.
(c) Other B30 equipment movement, loading, rigging, assembling, disassembling, and setting up.
(d) Emergency rescue and incident investigation.

CHAPTER 32-3
UAS OPERATION PERSONNEL, PREPARATIONS AND PRACTICES

SECTION 32-3.1: FLIGHT OPERATION PERSONNEL

32-3.1.1 General
(a) Personnel shall be competent to perform their assigned tasks as required by the applicable
codes, standards, site requirements and this standard.
(b) Personnel responsible for the supervision, operation, inspection, or maintenance of the UAS
shall be familiar with the applicable contents of the manuals furnished by the UAS manufacturer
as well as how to:
   (1) Determine the need for waivers, LAANC notification/approval, notice to airports or
       heliports.
   (2) Validate the expected weather during flight operations.
   (3) Assign and train UAS support personnel.
   (4) Verify that the UAS operator certificate and UAS registration are valid.
   (5) Verify that all required UAS manufacturer documentation is present.
(c) Other B30 equipment personnel involved with UAS operations, shall be competent to perform
their assigned tasks as specified in those B30 Standards and as required by any applicable codes,
standards, and site requirements.
(d) Personnel assigned tasks associated with the UAS flight operation or the involved other B30
equipment shall receive briefings specified in this Standard.
(e) As a minimum, UAS flight operation briefings shall identify the following:
    (1) The RPIC.
    (2) The UAS operator.
    (3) The Visual Observer(s) and other support personnel as applicable.
    (4) The lift director, as applicable.
    (5) The other B30 equipment personnel, as applicable.
    (6) The site owner, as applicable.
    (7) The specific tasks and responsibilities of the persons identified above.
    (8) A description of the UAS that will be utilized, capabilities of the UAV, flight purpose
and the plan for the flight that includes:
       (-a) Takeoff and landing, primary and alternate locations.
       (-b) Planned flight path.
       (-c) Potential distance from flight area that could cause loss of communication.
       (-d) Expected battery life for flight operation.
       (-e) Any identified airspace prohibitions.
(9) The communication method, equipment and practices that will be used with any backup methods.

(10) The potential physical hazards and conditions that could arise during the flight operation, including:
   - (a) Unanticipated people or equipment entering flight area.
   - (b) Unanticipated and anticipated aircraft entering the flight area.
   - (c) Physical features around the site, such as power lines, structures or communication devices that could disrupt communication with the UAS or be a hazard to the flight operation.
   - (d) Situations / conditions which would require stopping UAS flight operations.

(11) The environmental hazards that could arise during the UAS flight operation that are “not acceptable” and “unanticipated” and that would cause the halting of flight operations.

(12) The potential UAS malfunction hazards, including, but not limited to emergency procedures related to:
   - (a) Loss of control.
   - (b) Loss of communication with the UAV.
   - (c) Failure / low battery power down of UAS and controller.
   - (d) Physical failure of a UAV, including a payload drop.
   - (e) Emergency landings / zones and locations.
   - (f) Unsafe / safe locations around the UAS flight area.

SECTION 32-3.1.2: Responsibilities

(a) General
   (1) A single individual may perform more than one of the positions listed in this section, however there shall be at least one RPIC and one Visual Observer designated for a flight operation.
   (2) All of the responsibilities listed in this section shall be assigned to personnel supporting the flight operation.

(b) Remote Pilot in Command (RPIC) - shall be responsible for, as a minimum:
   (1) Determine that the UAV is of a size, weight, and characteristics to be able to adequately perform its required tasks.
   (2) Determining what the applicable regulations are at the flight location and assuring that their requirements are followed.
   (3) Ensuring that regulations applicable to the flight are reviewed by the UAS operation personnel and steps have been taken to ensure their compliance, including getting any required waivers or clearances.
   (4) Determining the personnel competency requirements needed for the personnel supporting the flight operations.
   (5) Determining that the personnel competency and proficiency requirements established by the applicable regulations have been met, prior to the commencement of any flight operations.
   (6) Verifying that all required flight operation documents are available, and any required inspections, maintenance, or tests of the UAS have been accomplished before the start of flight operations.
   (7) Verifying competent persons have been assigned to perform the UAS support functions
   (8) Supervising the flight operations.
   (9) Accomplishing other tasks that are needed to enhance the safety of the flight operations.
   (10) Conducting flight operations only when they feel physically and mentally fit to perform the operation.
   (11) Designating the appropriate number of support personnel for performing the flight operation.
(12) Preparing a flight plan and ensuring that the plan is retained as part of the job site records.
(13) Holding a pre-flight operation briefing attended by personnel involved in the flight operation, and if individuals are changed during a series of flights, briefing each new person appropriately.
(14) Ensuring that the pre-flight briefing addresses, as a minimum:
     - (a) The operational requirements of this Standard.
     - (b) The assignment and responsibilities of each person involved in the flight operation.
     - (c) The procedures to be followed during flight operations.
     - (d) Guidance on general and specific safety enhancing precautions.
     - (e) Communication methods and / or signals for the flight operation.
     - (f) Any unique considerations of the flight operation.
     - (g) Tasks to be accomplished during the flight operations.
     - (h) Emergency procedures for the loss of control signal, communications or UAS malfunction.
     - (i) Identification of the recognized hazards identified by the flight’s planning.
     - (j) Identification of the anticipated weather conditions during the flight and the variances that would necessitate the flights termination.
(15) Terminating flight operations if hazardous conditions develop.
(16) Developing a description of the purpose of the flight, with a listing of the flight’s desired results at the completion of the flight operations.
(17) Coordinating the UAS operations with the lift director.
(18) Verifying that the UAS programing and control system software is correct and appropriately updated.
(19) Wearing the personal protective equipment (PPE) required and appropriate for the site and flight operation.

(c) **UAS Operator.** At a minimum, the UAS operator shall be responsible for:

1. Flying the UAS only when the requirements of this standard have been met.
2. Flying the UAS in a careful and safe manner.
3. Flying the UAS only into a location where such operation is permitted.
4. Conducting flight operations only if they feel physically and mentally fit to perform the operation.
5. Not engaging in any practice that will divert their attention while controlling the UAS.
6. Responding to commands only from the RPIC or another designated person.
7. Stopping UAS operations whenever they have any doubt as to the safety of the operation and consult with the RPIC and lift director before re-initiating / commencing operations.
8. Understanding and applying the UAS manufacturer’s documentation for specific safety instructions and limitations on the UAS operation.
9. Inspecting the UAS setup and flight area before the flight operations and reporting their observations to the RPIC. These inspections shall, as a minimum, include inspecting the area for potential hazards, such as:
   - (a) Physical obstructions and electrical transmission and distribution lines
   - (b) Potentially hazardous geographic locations.
   - (c) Wind, weather, or unacceptable flight or task conditions
10. Not wearing clothing or body accessories that inhibit their ability to correctly use or function the controls or sense any indications provided by the controls.
11. Not allowing the UAS to be used as a dedicated spotter in assisting operations in proximity to electrical conductors.
12. Not flying the UAS to a position closer than 50 feet (15 m) of an electrical transmission or distribution line.
13. Not operating the UAS while under the influence of alcohol or while using any drug that could adversely affect their ability to control the UAS.
(14) Notifying the other B30 equipment operator prior to the UAS entering the air space that
extends to 23 feet (7 m) above the highest extension of the B30 equipment structure and
23 feet (7 m) horizontally from any portion of the equipment structure.
(15) Operating only one UAS at a time.
(16) Ensuring that any object attached to or carried by the UAV is secure and does not
adversely affect the flight characteristics or controllability of the UAV.
(17) Enabling the GPS when flying outside of enclosed spaces.
(18) Wearing the personal protective equipment (PPE) required and appropriate for the site
and flight operation.

(d) Visual Observer(s). As a minimum the visual observer(s) shall be responsible for:
(1) Accomplishing the tasks assigned by the RPIC to include notifying the RPIC of:
   (-a) Changes in weather conditions that could impact safe operations.
   (-b) The presence of natural and manmade hazards (e.g., ground traffic, aircraft intrusion,
        worker distraction).
   (-c) Intrusion of UAS operation airspace by other aircraft.
   (-d) Movement of other B30 equipment.
(2) Not engaging in any practice or have any other duties that will reduce the safety of the
    flight operation.
(3) Wearing the personal protective equipment (PPE) required and appropriate for the site
    and flight operation.
(4) Not acting as a visual observer while under the influence of alcohol or while using any drug
    that could adversely affect their ability to perform assigned tasks.

(e) Support Personnel. As a minimum support personnel shall be responsible for:
(1) Accomplishing the tasks assigned by the RPIC.
(2) Not engaging in any practice or have any other duties that will reduce the safety of the
    flight operation.
(3) Wearing the personal protective equipment (PPE) required and appropriate for the site and
    flight operation.
(4) Not acting as a support personnel while under the influence of alcohol or while using any
    drug that could adversely affect their ability to perform assigned tasks.

(f) Lift Director. As a minimum the lift director shall be responsible for:
(1) Coordinating the UAS tasks, as requested by the RPIC.
(2) Not engaging in, or authorizing, any practice or other duties that will reduce the safety of
    the flight operation.
(3) Wearing the PPE required and appropriate for the site and flight operation.
(4) Not acting as a lift director while under the influence of alcohol or while using any drug
    that could adversely affect their ability to perform their assigned tasks.
(5) Coordinating with the site controller and/or site owner and discussing the following:
    (-a) Clearance requirements from the UAV operations for the safety of site personnel and
         the public
    (-b) Potential hazards and controls for personnel involved in the UAS activities.
    (-c) The boundaries of the work zone and how to keep personnel out of the area.
    (-d) Informing personnel on staying out of the UAV’s operating area.
    (-e) Schedules of the UAS operations.
(6) Being the liaison between UAS activity and other activities at the site.

SECTION 32-3.2: FLIGHT OPERATION PREPARATION

32-3.2.1 Flight operation preparation activities take place at many locations, in many different time frames
and requiring many different skills which preclude the establishment of any precise personnel
responsibilities or accomplishment timing, however, all the preparation activities listed in this section
shall be accomplished, as generally indicated.
32-3.2.2 Prior to flight operations, a description of the purpose of the flight operation, including the flight’s desired results at the completion of the flight operations, shall be developed along with the designation of an RPIC for each UAS in operation.

(a) If there is a potential for conflicts during simultaneous UAS flight operations a RPIC shall be designated to coordinate the operations.

32-3.2.3 Prior to the start of flight operations the following actions shall be accomplished:

(a) A physical visual survey of the flight operation site that identifies:

(1) Physical hazards or conditions that could impact flight operations.

(2) Physical flight support requirements.

(b) The gathering of documentation that establishes the:

(1) Regulatory bodies and other authorization entities that are responsible for the authorization and / or approval of the UAS flight operation.

(2) Verification that any required notifications or authorizations of the applicable entities have been accomplished.

(-a) Any required flight authorizations have been / will be received.

(-b) Any site approval or coordination requirements have been / will be met.

(c) Defining the UAS flight operation personnel requirements and the communication methods to be used with those personnel.

(d) Ensuring that the UAV’s physical configuration, with its sensors and flight characteristics, meets the requirements of this standard.

(e) An evaluation of the potential for site electronics creating electronic interference adverse to the UAS operation.

(f) A determination if a lock-out or tag-out of any equipment is needed and the establishment of the implementation criteria, actions, and responsibilities for accomplishment.

(g) Planning activities that:

(1) Define how to coordinate with the RPIC, lift director and / or site owner(s) of the area in which the flight operations are to take place.

(2) Establish that the RPIC, lift director or site owner have the authority to stop operations when a condition detrimental to the flight operation is determined.

(3) Determine what flight clearance requirements apply to the area and establish that the flight operation will have the required authorizations to encroach on the existing air spaces or flight paths.

(4) Define the potential flight hazards and their mitigation, to include as a minimum:

(-a) Any issues, inside or outside of the operation area that could adversely impact the flight operation.

(-b) Any interferences or hazards that could adversely impact the flight operation (e.g., Physical, Electromagnetic).

(-c) Physical geographic or environmental conditions that could adversely impact the flight operation.

(5) Define the control methods to be used to ensure that flight operations do not take place over persons not directly involved in the operation.

(6) Define the boundaries of the flight operation and the methods to be used to keep unauthorized persons out of the area.

(7) Define the time limits of each UAV flight, in terms of equipment battery life and task accomplishment duration.

(8) Define the content of the pre-flight meetings including the indoctrination of personnel on how to stay out of the flight operation area.

(9) Define the PPE that will be required for personnel involved in the flight operation.

(10) Define the qualification requirements for persons assigned tasks in the flight operations.
(11) Define all permits, licenses, approvals, authorizations, or waivers that will be required prior to the start of flight operations.

(12) Define the UAS flight operation equipment required to support flight operations (e.g., anemometer, weather alert radio, communication radios).

(13) Define the allowable times of day, altitudes, visibility limitations and weather conditions (wind speeds/ wind gusts/precipitation/temperature) that will be allowed to exist during the flight operations.

(14) Define the flight area’s known obstructions and / or recognized conditions and the hazard they create to the flight operation (e.g., power lines, other UAV’s, structures, communication towers and devices that could disrupt communication with the UAV and the UAS Operator controls).

(15) Define the emergency action procedures and support requirements for UAS operation malfunctions such as:
   (-a) Battery power failure / battery fire.
   (-b) Loss of control / signal to UAS.
   (-c) Payload / UAV failure and drops.
   (-d) In-air UAS Failure.
   (-e) The UAS impact with surrounding structures.
   (-f) Failure of the primary means of communication between operation personnel.
   (-g) Airspace encroachment.
   (-h) Bird strikes.
   (-i) Interference with flight support personnel by unauthorized personnel.

(16) Identify the potential emergency landing locations / zones in case of UAS malfunction that are:
   (-a) Clear of obstructions and accessible to the UAV.
   (-b) Free of vehicles and personnel, either stationary or transiting.

(17) Define the UAS’s pre-flight testing and inspection actions that will be completed prior to the initiation of flight operations. As a minimum, these actions shall include the UAS manufacturer’s requirements and the accomplishment of:
   (-a) A self-test on, and an inspection of the UAS to be used, as defined in the equipment documents provided by each equipment’s manufacturer or a qualified person.
   (-b) A condition evaluation of the equipment’s structure, batteries, and propellers.
   (-c) A test of the communication methods and equipment to be used to support flight operations between the UAS operator, visual observer(s), other B30 equipment operator(s) and any other needed location / person.
   (-d) A verification that all frequencies to be used are appropriate and sufficiently secure to support the flight operation.
   (-e) Establishing any other B30 equipment movements that will be accomplished during the UAS flight operation.

(18) Establish any special requirements, for other than normal operations, such as, but not limited to:
   (-a) Multiple UAS operations at the same site in the same flight time window.
   (-b) Emergency rescue or accidents / incidents.
   (-c) UAS operation over public accessed areas.

SECTION 32-3.3: FLIGHT OPERATION PRACTICES

32-3.3.1 General
   (a) The operations of UAS shall be in accordance with the provisions included in this Standard, and the safety provisions furnished by the manufacturer of the UAS in the documents required in para. 32-0.4.1.
   (b) The UAV shall not be flown with any load that does not meet the volume’s defined requirements for a “payload”.
(c) When concerns as to the safety of the flight operation are expressed by personnel assigned as part of the UAS flight operation, the lift director, or the site owner, they shall be appropriately addressed to the satisfaction of the RPIC, lift director, and site owner.

(d) Flight operations shall not be conducted over unprotected persons who are not support personnel, (e.g., inside a structure) and should not be conducted over support personnel.

(e) Unplanned movement of the other B30 equipment during UAV flight operations shall be coordinated with, and approved by, the RPIC and lift director.

(f) Flight operations outside of a structure shall only be conducted within VLOS and:
   (1) The UAV shall remain within VLOS of the UAS operator or a visual observer unless the appropriate approvals or waivers by the applicable regulatory agency have been issued.
   (2) The UAV shall be operated near enough to the UAS operator or visual observer for them to be capable of seeing the UAV with their vision, unaided by any device other than corrective lenses.

(g) Flight operation locations where a UAV is being flown in structures, in darkness or partial darkness, shall use lighting systems that provide the UAS operator or visual observer(s) a clear view of the UAV and its flight orientation.

(h) Flight operations inside a structure, where VLOS is impractical, shall use FPV.

(i) Flight operations should take place between the local time of civil sunrise and sunset.

(j) The GPS shall be enabled when flying outside of enclosed spaces.

(k) Barricades shall be established around designated landing and takeoff areas and only the designated support personnel are to be allowed within those barricades.

(l) At least one visual observer shall be used to support the flight operation of each UAV.

(m) UAVs shall be marked in accordance with applicable regulatory requirements.

32-3.3.2 Communications
   (a) Hand signals, if used, shall be agreed to by all involved parties, prior to the start of flight operations.
      (1) Signals shall be discernible to the intended recipient of the signal.
      (2) No response to a signal shall be made unless the signal is clearly understood.

   (b) If communications between the UAS operator and signaling personnel are disrupted, all operations shall be stopped until suitable communication is reestablished.

   (c) If radios, or other electronic means of communications, are used, they should operate on a dedicated channel available to assigned personnel, as determined by the lift director and the RPIC.

   (d) Communication systems to be used during the flight operation shall be verified as functioning and effective prior to commencing flight operations.

   (e) Radios or other electronic means of communications shall be checked for correct operation in accordance with the manufacturer’s recommendations, prior to a UAS’s flight at a site.

32-3.3.3 During UAV flight
   (a) The UAV shall:
      (1) Be controlled during its entire flight.
      (2) Be stopped when:
          (-a) Instructed by an appropriate regulatory authority.
          (-b) Weather conditions exist that adversely impact safe flight operations.
          (-c) Unplanned aircraft enter the planned UAV flight area.
          (-d) Unauthorized persons enter the UAV flight area.
          (-e) Any event or condition exists that adversely impacts the safety of the planned flight operation.

      (3) Yield the right of way to all aircraft.
      (4) Not be flown within 5 miles (8 km) of an airport, or as specified by the airport, without notifying the airport operator and having received appropriate authorizations.
(5) Not interfere with the operations and traffic patterns of any airport, heliport, or seaplane base, except where a mixed-use agreement is in effect.

(6) Not be flown within controlled or restricted airspace without prior notification and authorization of the appropriate authority. (e.g., LAANC, military).

(7) Not be flown over unintended people, vessels, vehicles, or structures.

(8) Not be flown closer than 23 feet (7 m) to any individual, except for the UAS Operator and the support personnel during takeoff and landing.

(9) Not be flown higher than is required to accomplish the planned flight operation.

(10) Not be flown higher than approximately 400 feet (122 m) above ground level, except when the B30 equipment, being supported, height exceeds 400 feet (122 m) above the ground (e.g., crane or derrick on the roof of a tall building).

(11) Not exceed its designed and/or regulatorily allowed takeoff weight.

(12) Not be touched by support personnel while in powered flight, except to divert it from striking an individual.