BOAT INCIDENT INVESTIGATION STANDARD – Final draft 2/28/2022

SCOPE

Recreational Boating Incident Standards of Investigation are for use in curriculum development and training of recreational boating incident investigators in the U.S. States, Territories, and District of Columbia. These Standards provide commonality for recreational boat incident investigations, general vessel terminology, navigation rules and regulations, environmental distractions, witness interviews, collision dynamics, evidence collection and preservation, diagramming, and report writing, including adherence to definitions and detail in the incident narrative with particular focus on human factor causal elements. Standards are developed with intention to be recognized as the industry standard.

The Boating Incident Investigator will be able to complete each of the following:

1.0 Introduction and Background

1.1 Define "boating accident" (synonymous with "boating incident").

1.2 Define "vessel" as it relates to the U.S. Coast Guard's (USCG) definition (33 CFR 173.3) understanding some states/territories may expand upon the USCG term.

1.3 Understand why boating incidents are reported and investigated (e.g., boating safety programs, regulations, statistical research, insurance, criminal proceedings, determine if vessel types should be subject to recall, etc.).

1.4 Explain the types of accidents per the USCG accident type list and additional terms per the USCG/ERAC Accident Reporting Terms and Definitions Project. (See https://www.nasbla.org/nasblamain/lighthouse/get-equipped/accident-reporting-terms.)

1.5 Understand the criteria for a USCG Reportable vs. Non-reportable Accident, including incidents without vessel damage (e.g., electric shock drowning, carbon monoxide poisoning, etc.).

1.6 Explain the importance of the Boating Accident Reporting Database (BARD), and understand why and how report entries are created in BARD (e.g., accident types - primary, secondary, tertiary; accident contributors – primary, secondary, tertiary) per the USCG/ERAC Accident Reporting Terms and Definitions Project *(See 1.4).*

1.7 Explain Defect Notifications (recalls), where to report a defect, and why it is important.

1.8 Understand fraud and its role in boating investigations (e.g., altered HIN, stolen vessels, insurance claims, financial payouts, etc.).

1.9 Explain the investigative partnership between the USCG and states to accurately and effectively investigate boating incidents, and how it affects the Recreational Boating Safety (RBS) Program.

1.10 Understand vessel manufacturer and construction regulations, factory compliance, inspections, testing, and approval numbers (e.g., USCG and state regulations [CFR, state statutes], Industry voluntary standards [ABYC, NMMA, Underwriters Laboratories], etc.).

1.11 Understand incidents involving lightning and high voltage electricity contact.

1.12 Understand the importance of ignition protection systems as it relates to fires and fire prevention (e.g., approved components, testing, identification, etc.).

1.13 Understand gasoline systems (e.g., components, proper installation, types, uses, etc.).

1.14 Understand ventilation systems (e.g., components, proper installation, proper uses [blowers, etc.], powered vs. natural, open/open to environment, etc.).

2.0 Vessel Systems: Ignition, Fuel, Ventilation, Electric

2.1 Lightning and Other High Voltage Incidents

2.1.1 Identify important design considerations and benefits outlined by the ABYC Technical Information Report TE-4 regarding lightning protection (e.g., use of an air terminal, lightning bonding conductor, lightning grounding terminal, bonding system not connected to thru-hull fittings, etc.).

2.1.2 Describe the components and benefits of a lightning protection system (e.g., wire size minimum 4 AWG, mast, or pole to provide cone of protection straight vertical electrical path, ground plate one square foot surface area, etc.).

2.1.3 List the characteristics of lightning (e.g., travels in straight line, strikes tallest grounded conductor in the immediate area, short duration [1/4 second], high voltage [over 1 million volts], high current [over 20,000 amps], etc.).

2.1.4 Describe the locations and type of damage that can occur from lightning discharge. (e.g., discharge such as burn patterns on mast, exit damage to hull, damage to thru hull fittings, outdrive, propellers, shafts or rudder, electronics not working, burned fuses, electrical panel burns, etc.).

2.1.5 Identify physical evidence that may result from contact with high voltage power lines. (e.g., burn patterns on mast, damage to shrouds, burn marks on deck from melted metal, electronics not working, electrical panel burns etc.).

2.1.6 Discuss investigation considerations for lightning / high voltage accidents (e.g., was there a lightning protection system, did it fail, was vessel being operated in restricted area, determining mast, overhead power line heights, etc.).

2.2 Ignition Protection

2.2.1 Define what ignition protection is and its importance.

2.2.2 Describe where ignition protected equipment is required .

2.2.3 How to identify proper EIP (external ignition protected) components.

2.2.4 Understand important elements during post event inspection of components, including use of non-EIP devices where EIP would be required.

2.3 Fuel systems

2.3.1 Identify the Federal law and industry standards for fuel systems

2.3.2 Define Important changes in boat mounted fuel systems related to evaporative emissions

2.3.3 Identify types of appropriate fuel hoses, identification of such, where they are used, and compliance of stainless steel jacketed hoses.

2.3.4 Describe fuel tank types and failure points.

2.3.5 Explain fuel system test procedures.

2.4 Ventilation Systems

2.4.1 Identify the Federal law and industry standards for ventilation systems.

2.4.2 Describe the ventilation system types.

2.4.3 Describe the purpose and limitations of ventilation systems.

2.4.4 Describe post-event inspection techniques.

2.5 Electrical Systems

2.5.1 Describe electrical system regulations and standards related to wire types, circuit protection, and safety to investigators.

2.5.2 Describe DC systems on boats, including:

- Battery types including Li-Ion replacement batteries (refer to ABYC Standard), and
- Charging requirements (i.e. different battery chemistries and requirements, use of non-marine, (not EIP) chargers, etc.).

2.5.3 Describe AC systems on boats including onboard generators and dock systems, including:

- Examples of shore power cord issues, and
- Charging of electric propulsion units.

3.0 Electric Shock Drowning (ESD)

3.1 Define what electric shock drowning is, list what an individual may experience as a result of ESD (e.g., slight tingling, loss of muscle control, ventricular fibrillation), and be able to describe when it should be reported to the USCG as a reportable boating incident.

3.2 Describe the proper functioning of a vessel's AC (Alternating Current) system (e.g., AC current enters the vessel via shore power cord, returns to its source by green grounding wire), and the various ways a faulty ground can occur on a vessel connected to shore power (e.g., failure to use green grounding wire, underwater metal fixtures are energized, electricity seeks new path back to earth ground, etc.).

3.3 List the circumstances that can cause stray AC electric current to occur in water surrounding a boat or dock (e.g., failure to ground green wire back to dock, a break in the shore cord or dockside power supply, 'hot dock' – energized dock and surrounding waters due to faulty dock wiring, lack of GFCIs, etc.) and the type of water and why this occurs most frequently (fresh).

3.4 Define how an electric field can occur around boats and docks (e.g., stray AC field sets up around source, voltage diminishes by distance from source (intermittent or constant voltage) dependent upon water conductivity (fresh, brackish).

3.5 Describe a typical scenario involving stray AC electricity in the water (e.g., human body as conductor in fresh water, victim entering water may suffer tingling up to muscle paralysis resulting in drowning, possible injury or death from electrocution, or heart failure).

3.6 List reasons why ESD is considered a silent killer (e.g., lack of indicators of energized water, false impression of safety, intermittent electrical source, inability to call for help, etc.).

3.7 List actions to take when responding to a possible ESD incident (e.g., secure scene, shut off all power sources to boat(s) and dock, disconnect all shore power cables, do not enter water to retrieve victim, use reaching device, note specific location of victim in water, how long symptoms are experienced, eye witness statements, etc.).

3.8 Define the reasons why ESD events may occur more frequently than suspected and how they are challenging to investigators (e.g., ESD fatalities are often considered drownings, no post-mortem evidence of electrocution, intermittent or missing electrical source, etc.).

3.9 Describe the steps an investigator can take to determine the source of stray AC (e.g., seek help from qualified commercial electrician, marina staff, ABYC certified marine electrician, etc.), including use of a safe testing tool / method (e.g., digital multimeter with brass plates, conductors, etc.).

3.10 List the reasons that stray AC in a marina could exist but not be detected (e.g., intermittent AC source from cycling vessel appliances, source vessel no longer at marina, tripped circuit breaker, etc.).

4.0 Carbon Monoxide (CO)

4.1 Define what carbon monoxide (CO) poisoning is and be able to define when it should be reported to the USCG as a reportable boating incident.

4.2 List how carbon monoxide is produced by internal combustion engines and understand the properties of CO (e.g., colorless, odorless, tasteless gas, density similar to air, slow dissipation rate, more stable than oxygen in blood).

4.3 Understand the physiological effects of CO (e.g., readily absorbed by the lungs, reacts with hemoglobin in the blood to form Carboxyhemoglobin, reduces the oxygen carrying capacity of red blood cells, CO binds in blood 240 times more easily than oxygen) and its resulting lack of oxygen to the tissues and subsequent tissue death.

4.4 List the signs and symptoms of CO Poisoning which often mimic other conditions:

- Mild Exposure – slight red or flushed skin color, fatigue, nausea, headache, etc.
- Medium Exposure – severe headache, confusion, drowsiness, rapid heart rate, etc.
- Severe Exposure – unconsciousness, convulsions, cardiac/respiratory failure, death, etc.

4.5 Understand the cumulative effects of CO from the length of exposure time or the level of CO concentration as measured in parts per million (PPM), including what may aggravate its effects (e.g., smokers, lung disorders, alcohol consumption, heart problems, physical exertion, etc.).

4.6 Understand the risk to first responders and the best methods to mitigate dangers when called to potential CO poisoning cases (e.g., using CO monitor or utilize fire personnel equipped with self-contained breathing apparatus [SCBA] protection).

4.7 List what immediate and possible medical treatments can be used for CO exposure (e.g., immediate removal from CO exposed area to decontaminate, notification of EMS, and clinical action of oxygen therapy or possible hyperbaric chamber, etc.).

4.8 Be able to describe the sources of CO most common on vessels (e.g., internal combustion engines, open flame devices, idling gasoline engines and generators of nearby boats, back drafting/station wagon effect, teak surfing, platform dragging, defective or worn machinery, etc.).

4.9 Understand mitigation techniques and technology on vessels such as rerouting generator exhaust away from common swimming areas or addition of emission control devices.

4.10 Cite the ABYC Standard A-24 and NFPA 302 that requires a CO detection system on all boats with enclosed accommodation compartments and a gasoline powered generator or inboard gasoline propulsion.

4.11 List potential investigative questions and issues to consider when investigating potential CO poisoning.

4.12 List/cite additional educational resources for information that is printable for marine law enforcement or recreational boaters.

5.0 Fires and Explosions; Fraud Indicators

5.1 List the three elements necessary for a fire or explosion (e.g., fuel/accelerant, oxygen, and an ignition source).

5.2 List the main possible flammables found on boats and their characteristics:

- Gasoline: heavier than air; explosive mixture 1.4 to 7.6%
- Compressed Natural Gas (CNG): lighter than air; explosive mixture 5.0 to 15.0%
- Liquefied Petroleum Gas (LPG): heavier than air, 2.1 to 9.5%
- Hydrogen: lighter than air, 4.0 to 75.0%

5.3 List the boat systems that can contribute to fires and explosions (e.g., fuel system, electrical system, exhaust system, ventilation system, liquefied petroleum gas [LPG] appliance system, etc.).

5.4 List examples of conditions related to the above boat systems that have contributed to fires (e.g. deteriorated fuel fill hoses, improper electrical service, blower motor hose below bilge water level, etc.).

5.5 Describe the US Coast Guard reporting requirements for boat fires (e.g., operation underway not pre-requisite, incident is reportable if fire or explosion occurred while underway or while anchored, moored or docked if fire resulted from vessel or its equipment).

5.6 List safety precautions to be taken during fire investigations (e.g., ensure the boat is stable before boarding / examination, structural integrity of the boat, de-energize all power circuits that create safety hazards [AC shore power, DC batteries, chargers, inverters], etc.).

5.7 List safety concerns to be addressed prior and during a fire / explosion investigation (e.g., fuel leaks, airborne particulates, atmospheric issues, hazardous materials, sewage holding tanks, automatic extinguishing systems, etc.). (Reference NFPA 921)

5.8 Describe the general fire / explosion investigative process (e.g., always consider the possibility of arson, investigate all vessel systems simultaneously in a coordinated method, consider depth of char, V and other patterns, look for evidence of fire trailers, determine which occurred first - explosion or fire, etc.).

5.9 List investigative questions to be asked about the fire scene history, such as:

- Before the fire (e.g., when was boat last operated, for how long, number of hours on engines, were boat systems operating normally, when was boat last serviced, what was its maintenance history, when was boat last fueled [how much and fuel type], what auxiliary equipment was on board or operating, etc.).
- During the fire (e.g., how long was the boat in operation, boat speed, boat route, environmental conditions [weather / water], when and where was smoke or flame first noticed, estimated time of burn, how extinguished, when help arrived, etc.).
- After the fire (e.g., what were the locations of occupants and victims, their actions, what actions were taken by other agencies [fire departments, US Coast Guard, law enforcement], were there prior incidents / investigations of this boat, etc.).

5.10 Describe the primary fraud indicators possible in boat incidents (e.g., boat sinkings under suspicious circumstances, to include single occupant rescued by good Samaritan in deep water, engine water intakes cut, boat found stripped of electronics and high value items, no personal gear; suspected arson and suspicious fires, including use of accelerants, unusual open fuel sources; older boats with poor maintenance history, needing major engine repairs, boats for sale for very long time periods prior to incident, boat owner going through financial stress, recent increase in insurance coverage, etc.).

6.0 Vessel Construction and Nomenclature

6.1 Identify the various types (e.g., displacement, semi-displacement, planing) and designs of boat hulls (e.g., flat, round vee, cathedral/ multi-hull, catamaran deep-vee) that are involved in incidents.

6.2 Use proper nautical terminology regarding parts of a vessel (e.g., length, beam, bow, stern, port, starboard, helm, transom, freeboard, draft, keel, etc.) and vessel construction (e.g., chine, lifting strake, structural hard spots), and emphasize the use of those terms in an incident investigation.

6.3 Describe the characteristics of vessel construction and nomenclature of the vessel per 33 CFR 173.57(C)(23), including:

- Type: authorized terms are “air boat”, “auxiliary sail”, “cabin motorboat”, “houseboat”, “inflatable boat”, “open motorboat”, “paddlecraft”, “personal watercraft”, “pontoon boat”, “rowboat”, “sail only”, or “other”;
- Propulsion: authorized terms are “air thrust”, “manual”, “propeller”, “sail”, “water jet”, or “other”;
- Fuel: authorized terms are “electric”, “diesel”, “gas”, or “other”;
- Engine drive type: authorized terms are “inboard”, “outboard”, “pod drive”, “sterndrive”, or “other”.

6.4 Describe additional systems utilized in recreational boating beyond those identified in the 33 CFR 173.57(C)(23) (e.g., counter rotating props, v-drive inboards, surface drives, bow thrusters, etc.).

6.5 Identify evolving trends in vessel design and technology (e.g., hydro-power jet packs, tritoon pontoon boats, tunnel cutouts in hulls, wake board boat modifications [extra ballast and power wedges], stabilizer fins, wakeboard towers, step hulls, electric power, etc.).

6.6 Understand how boats are manufactured to better understand damage that occurs as a result of a boating incident and types of construction materials (e.g., authorized terms per 33 CFR 173.57(C)(23) are “aluminum”, “fiberglass”, “plastic”, “rubber/vinyl/canvas”, “steel”, “wood”, or “other” (e.g., polyethylene, polyester fabric, carbon fiber, etc.), and construction processes [including 3-D printing], flotation requirements [basic, level], finishing and rigging, etc.).

7.0 Vessel Stability

7.1 Understand the basic principles of stability in the recreational boating environment with emphasis on longitudinal and transverse stability, dynamic stability, buoyancy, and gravity. This will also include the incident types that are commonly associated with the lack of stability such as: capsizing, ejection from vessel, falls overboard, sinking, swamping, flooding, etc.

7.2 List and understand situations that may lead to vessel overload (e.g., too many people, too much weight, or combination of both persons and weight). Understand capacity plates (e.g., how weights and horsepower limits are determined, vessel exemptions, etc.), display requirements (e.g., vessel type exceptions, etc.), how capacity plates may be enforced, and how to calculate capacity limits when a plate is not displayed per 33 CFR Subpart C.

7.3 List causes and contributing factors of high speed instability incidents or the loss of dynamic stability (e.g., excessive speed for conditions, high speed turns, steering torque, bow steer, design flaws, stepped hulls, engine torque, propeller torque, water conditions, high trim angle, malfunctions of the steering system, porpoising, chine walking, improper loading, etc.).

7.4 Understanding the factors that affect the stability of vessels (e.g., occupant activity, loading/unloading, onboard liquids [fuel, bilge water, etc.] or ballasts, wind, vessel form, vessel draft, vertical load, current, anchoring, etc.).

7.5 Define flotation requirements of vessel manufacturers per 33 CFR Subpart E through H (e.g., basic and level flotation and application to size and hull types, hull types exempted, etc.).

7.6 Understand the powering of vessels in regards to maneuvering speeds and vessel maneuvering speed test methods used by boat builders per 33 CFR 183.53(b)(3 - 5) and ABYC Standard H-26.

7.7 Understand the operational characteristics of vessels using engine lift assists (e.g., jack plates, etc.), trim tabs, and manual adjustment of trim angle. Understand steering assist systems (e.g., hydraulic steering, no-feedback steering system cables, hydraulic steering systems for tiller steer motors, etc.), and how these assist in the operation of a recreational vessel.

8.0 Investigative Procedures Overview

8.1 Identify the 16 stages of the systematic and chronological process for investigating a boating incident, including:

- Take a notification and prepare an appropriate response to the investigation scene.
- Know what actions to take upon arriving at the scene.
- Secure and protect the scene.
- Preserve potential electronic data.
- Conduct a preliminary survey.
- Identify and separate operators and passengers; check for impairment.
- Conduct interviews.
- Confirm coordination of recovery operation and death notification(s).
- Take photographs.
- Conduct detailed examination of boat(s).
- Conduct detailed examination of the scene.
- Collect, package and preserve evidence.
- Conduct a final survey.
- Release the scene.
- Conduct follow up interviews and investigation.
- Prepare investigative report.

8.2 Understand the recommended items for an investigative response tool kit and their uses.

8.3 Understand the importance of field guide(s) and job aides to be used by the investigator in the field.

9.0 Diagramming

9.1 Emphasize the importance and benefits of diagrams to illustrate the collision sequence.

9.2 Demonstrate different methods that can be used by investigators to create diagrams (e.g., manufacturer templates, CAD [Computer Aided Diagramming] software, free computer programs, Google Earth/Microsoft Maps, PowerPoint, etc.).

9.3 Know the difference between a sketch and a diagram and how each can be used in different stages of the investigation.

9.4 Understand the steps to preparing a diagram (e.g., organize all reference materials, review physical evidence, read witness statements, etc.).

9.5 Identify the different type of diagrams that may be useful in an investigation report (e.g., nautical charts, Topographic Maps, witness generated drawings, seating charts, investigative diagrams, injury diagrams, collision sequence diagrams, etc.).

9.6 List important items to be documented on investigative diagrams (e.g., a notation that the diagram is not to scale, a directional indicator for spatial reference, name or names of nearby roadways or landmarks for reference, label for the diagram, consistent vessel labeling, operational and collision dynamics notes, occupant kinematics, path of engagement, etc.).

9.7 Understanding of other methods of diagramming scenes and vessels (e.g., total station measurements, laser scan point cloud data, drone photogrammetry, etc.).

10.0 360 Degree Survey Method/Baseline Offset Measurements

10.1 Document damage manually when technology methods are not available using the 360 survey/baseline offset measurement method (e.g., set up four quadrants on a vessel, label those quadrants correctly, understanding of the X, Y, and Z reference points from which to measure damage, etc.).

10.2 Understand preparation for measurements that can be duplicated later (e.g., leveling the boat trailer, checking and equaling the tire air pressure, leveling the boat on the trailer, establishing X, Y, Z reference points, etc.).

10.3 Measuring all damage, evidence, or other points on a vessel by using a determined X, Y, Z axis and documenting those measurements on documentation forms (e.g., 360-degree sketch sheet and X,Y,Z documentation form).

10.4 Understand how and why to accurately measure the approximate angle of impact in degrees using a known initial contact point, critical striation, bow eye gouge, etc.

11.0 Human Factors

11.1 Describe the importance in determining why an operator failed to take appropriate action to avoid a collision or other type of boating incident.

11.2 Identify factors that contribute to human error in boating incidents (e.g., operator distractions to include:

- Sightseeing;
- Daydreaming;
- Fixated on other passengers, boats, objects;
- Eating, drinking, smoking;
- Passengers – conversation and actions;
- Operators and Passengers – horseplay on board;
- Onboard lighting – glare;
- Background lights – boat lights blend into background;
- Boating Congestion and diverted attention;
- On board electronics or equipment (e.g., GPS, cell phone, VHF radio, stereo system, etc.

11.3 Understand the difference between "Proper Lookout" (Nav Rule 5) and "Operator Inattention" and what precursor event proceeded each prior to the incident.

11.4 Understand awareness of an operator's perception and response as it relates to boating collisions and the ability of an operator to react to avoid a collision.

11.5 Recognize the possibility of applying perception and response to a time, speed, and distance analysis.

11.6 Apply the Time Speed Distance (TSD) calculation when at least two elements are known.

12.0 Conducting Interviews

12.1 Understand the difference between “physical evidence” and “witness statements”.

12.2 Understand the importance of witness testimony and its limitations.

12.3 Describe the interview process including key concepts (e.g., the difference between an interview and an interrogation; building a rapport; reducing distractions; etc.).

12.4 List advantages and limitations of recorded and written statements.

13.0 Narrative Report Writing

13.1 Define what is expected of a good narrative for a boating incident.

13.2 Describe the importance in writing a good narrative for a boating incident utilizing the “Good Practices: Writing Recreational Boating Accident Report Narratives,” a product of NASBLA’s Engineering, Reporting & Analysis Committee, 2016.

13.3 Ensure the narrative supports the details of the entire investigation.

14.0 Collisions - Introduction and Dynamics

14.1 Understand collision investigation and evidence analysis is a complex task which requires a good understanding of the ways boats are manufactured and the dynamics involved in the incident.

14.2 Understand the differences between a collision and allision.

14.3 Understand that a complete investigation of a boating collision requires the collection of all available information and accounts, and weighing the strength and validity of claims or theories against evidence.

14.4 Describe the basic principles of physics involved in a boat collision which include Newton’s laws of motion (e.g., law of inertial, law of acceleration, and law of action-reaction, etc.) and kinetic energy (the exchange and dissipation of energy in a collision).

14.5 Identify and provide examples of the two different types of dynamics and their effects:

- Operational dynamics (e.g., attitude, heeling vs. listing, heel angle, and vertical position, load conditions, trim angle, environment, boat design, etc.), and
- Collision dynamics (e.g., yaw, pitch, roll, depression and displacement, sliding, ramping/overriding, etc.).

15.0 Collisions - Damage and Evidence Assessment

15.1 Describe the reasons why damage assessment of collision vessels needs to occur prior to any incident analysis (e.g., lack of thorough investigation may lead to premature and unsupported analysis findings, missed internal structural damage, other evidence, etc.).

15.2 Understand components and properties of fiberglass (e.g., filaments, plastic resin, catalyst [hardener], resilient, elastic, tends to return to original shape, affected by sun exposure, etc.), and describe the various fiberglass construction methods and construction quality (e.g., may vary from boat to boat in same make/model, even in same vessel, variability within manufacturing processes, no industry standard of thickness, etc.).

15.3 Understand and identify structural hard spots found in fiberglass boats and how they affect vessel collision movement/dynamics (e.g., a weak hull area will absorb energy/damage, a reinforced area or hard spot may deflect an impacting boat and transfer energy, etc.).

15.4 Describe and identify the types of damage in fiberglass using consistent terminology, such as:

- fractures without separation;
- stress fractures in gel coat (hairline fractures and spider webbing);
- scratches (gouges and cuts);
- impressions;
- crush or compression damage;
- induced damage;
- transfer marks;
- striations;
- scuffs; and
- signature marks left by vessel engagement (e.g., bow eye damage, punctures or impressions; lower unit skeg mark, torpedo hole; propeller marks; hardware and fastener damage; heat/friction damage, etc.).

15.5 Describe the significance of the debris field documentation both inside and outside of the vessel with diagrams, photographs, videos or any other technology (e.g., three-D laser scanners/total stations including point cloud data; drones/unmanned aerial and underwater vehicles; etc.), and recognizing that the debris field may be available on the bottom of the waterway and on land.

15.6 Understand the importance of documenting locations of onboard objects as it may assist with determining the principal direction of force (PDOF). Discuss the difference between unrestrained items and restrained items:

- Unrestrained – more likely to shift and show movement (e.g., operator/occupants, PFDs, coolers, anchors, purses, portable gas tanks, tackle boxes, fishing rods, loose items in storage compartment, etc.)
- Restrained – Less likely to shift and show movement, but their movement is likely to indicate a significant amount of force (e.g., trolling motors, installed gas tank, 12-volt battery, seats, inboard engines [check mounting brackets], etc.).

15.7 Demonstrate use of all available electronic data sources, and knowledge of vessel characteristics, to determine the vessel(s) speed of collision such as:

- Engine Control Modules (ECM), GPS, cell phone data, etc.; and
- Using RPM, MPH Calculations (propeller pitch, gear ratio, slip factor).

15.8 Be able to assess the factors affecting the environment at the time of collision/incident (e.g., atmospheric conditions, environmental conditions, ambient light, line of sight, water releases/turbulence, CFS [cubic feet/second], tides, and traffic conditions), and demonstrate knowledge of recreating conditions at the time of the incident.

15.9 Demonstrate how to assess damage to metal boats including aluminum boats with welded or riveted construction, and describe how hull bends, dents and crushing are revealed on aluminum hulls.

16.0 Navigation Lights

16.1 Know the navigation light requirements per the Inland Navigation Rules (latest version), regulations, and standards for recreational vessels and the importance of verifying proper display, illumination, and functioning of these lights on vessels involved in collisions where proper navigation lights would have been required. This would also include the knowledge of appropriate times these lights are required per federal and state regulations (e.g., sunset to sunrise or in times of limited visibility).

16.2 Understand state and federal requirements for sidelight arcs/angles, and required visibility of recreational vessel light configurations per 33 CFR part 83, and ABYC Standard for Navigation Lights A-16, and how they can be used by boaters to determine navigational rules at night or in limited visibility situations.

16.3 Understand incandescent light bulb indicators that may be present after a collision (e.g., hot shock vs. cold shock) that would help the investigator determine if it was illuminated/not illuminated and the principal direction of force (PDOF).

16.4 Understand investigative questions that can be used to detect deception in a witness statement and understanding of the possibility of forensic examination of the bulbs, mounting hardware, and wiring.

16.5 Knowledge of lights that are being utilized on recreational vessels improperly with emphasis on the following:

- the rapid increase in the use of LED (Light Emitting Diode) lighting which may not comply with standards or regulations;
- use of accent, interior, or exterior lighting and how it may affect visibility for the vessel's operator or other vessel operators nearby; and
- awareness that lights can obstruct required navigation lights (e.g., utilizing docking lights and spotlights and how those may be law violations or lead to navigational hazards or confusion for other vessel operators nearby).

17.0 Injury Documentation

17.1 List the types of wounds (closed and open) and mechanisms of traumatic injuries that are a result of boating incidents and understand the importance of utilizing the correct terminology when describing and documenting them.

17.2 Understand the benefits of an investigator attending an autopsy and consulting with the medical examiner about the specific injury assessment.

17.3 Know how the concept of occupant kinematics and Newton's Laws will affect an occupant in a boating collision with an understanding of how safety standards in automobiles differ from boats (e.g., seat belts, air bags, crush/crumple zones, etc.).

17.4 Understand the variety of ways that lower unit/skeg/propeller strikes occur in boating incidents (e.g., ramping/overriding in a collision, fall overboard, ejected from vessel, failure to wear engine cut-off lanyard, etc.) and how those injuries can result in traumatic injury and death.

17.5 List what the common personal watercraft injuries are (e.g., blunt force trauma, head injuries, broken bones, contusions, etc.) and how occupant retention and protection differs from other recreational vessels.

18.0 Collisions: Evidence Analysis

18.1 Discuss how a systematic approach to collision investigations is performed (e.g., identify the specific types of damage to a boat and then relate that damage to the other boat or object involved, evaluate damage with intent to determine the operational and physical factors involved, establish a scenario that fits with all damage and evidence analyzed, etc.). Describe the reasons this leads to a comprehensive, thorough investigation (e.g., investigator analyzes all possible factors affecting vessel movements, outcomes, etc.).

18.2 List reasons why a deductive reasoning and systematic approach to collision investigation should be followed to establish a logical collision scenario (e.g., collect evidence; complete system tests; consider vessel operation and environmental factors on vessel attitude, coordinate all damage and evidence collected with knowledge of boat dynamics, etc.), prior to theorizing a probable conclusion.

18.3 Describe the importance of determining contributing factors and causes in collision investigations (e.g., working all damage, evidence, and statements into an analysis/theory of the collision that includes and accounts for all evidence and findings, etc.).

18.4 List and describe the types of damage / blows that can be found at the initial impact area and what they may indicate:

- Penetrating blows (clean breaks inward, concentrated/localized damage, may indicate acute angle impact or vessel rotation subject to vessel dynamics, etc.);
- Glancing blows (tearing breaks, extensive transfer, damage over larger area, indication of shallower approach angle, vessels in motion, etc.);
- Crushing blows (visible compression damage, crushed/compacted fiberglass, may indicate impact with stationary object or vessel, etc.); and
- Override damage (striations, scratches, especially on impacted vessel deck, impacting vessel hull, due to lower profile configuration of impacted boat, bow configuration of impacting boat, etc.).

18.5 Describe the importance of striation interpretation and analysis (e.g., use of striations on decking and hull of collision boats as actual visible indicators of vectors of force; use of initial striations as best indicators of boats' directions at impact before being affected by collision dynamics; striations may indicate relative velocity of one boat versus the other; may indicate evasive maneuver, etc.).

18.6 Describe and identify secondary impacts due to the inertia of unrestrained and restrained objects/passengers in the boat and how they correlate to the Principle Direction of Force (PDOF).

18.7 Identify and analyze pertinent switches and gauges that will play a significant role in the Boat Incident Investigation if they were not altered after the collision. (e.g., throttle (shift/lever), lower unit(s) trim angle, trim tab, navigation light switches, electrical gauges, etc.).

18.8 Describe and identify certain collision dynamics that are typically seen in Personal Watercraft (PWC) incidents, including:

- PWC tend to sustain less damage (rotate, depression, slide, and roll);
- Passenger susceptibility to injury (lack of protective structure);
- Off-throttle steering (OTS) loss because there isn't a skeg /rudder extending below the unit;
- Operator lack of training and experience; and
- Force of Jet Propulsion (e.g., intake and high-pressure outflow).

18.9 Understand the basic principles of fan propulsion and how OTS is affected with fan propulsion vessels.

18.10 Understand the 10-step process for analysis of collision damage, including:

- Identify and analyze initial impact area;
- Identify perimeter of damage and any induced damage;
- Identify path of engagement;
- Identify maximum engagement;
- Identify disengagement and any exit points;
- Identify direction of force due to impact;
- Identify any secondary points of impact;
- Match damage/transfer to other boat/object involved;
- Identify location of areas not damaged; and,
- Relate control positions and switches to the overall analysis.

19.0 Collision Analysis Exercise

19.1 Apply the methods, concepts, and terminology prescribed in this course to a boating incident investigation to instill confidence that the investigative procedures and knowledge can be effectively utilized and applied to a boating incident investigation.

19.2 Assess all the damage, evidence and the information provided in a case study in order to test the validity of all witness statements and to arrive at the most logical conclusion.

19.3 Present findings clearly and convincingly using the correct investigative procedures and terminology to describe the findings as to the events in the boating incident.

20.0 Additional Information

20.1 Identify and use additional information and references to aid and advance the investigation as required (e.g., paddlesport incident information, navigation rules, sample affidavits and subpoenas, drowning investigations articles, public relations and death notification, glossary, etc.).

Draft developed by the Boating Incident Investigation Workgroup, under USCG National Non-profit Grant Funding:

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Workgroup Voting Members and Interest Categories:

- Majors, Matt - Workgroup Co-Chair; Producer
- Dillon, Pamela - Workgroup Co-Chair; Producer
- Berry, James – User - Federal
- Castelli, Chris – Producer
- Chisholm, Pete – Producer
- Cooke, Jason – User - State
- Hawkins, Jim – User - State
- Hillyer, William – User - Federal
- Lundin, Eric – General Interest
- Turrell, Morgan – User - Federal
- Wagner, Seth – User - State
- Weinbrecht, Kenneth – General Interest

For additional information, contact BII_Standards@nasbla.org.

The 30-day public review period closes April 1, 2022. To download a copy of the draft standard, or to submit a comment, visit the Boating Incident Investigation Project on EZ-ESP at https://esp.nasbla.org/esp/.

For Announcement in BLA Brief and NASBLA Weekly

Public Review of Boating Incident Investigation Standards – Through April 1, 2022

Recreational Boating Incident Standards of Investigation are for use in curriculum development and training of recreational boating incident investigators in the U.S. States, Territories, and District of Columbia. These Standards provide commonality for recreational boat incident investigations, general vessel terminology, navigation rules and regulations, environmental distractions, witness interviews, collision dynamics, evidence collection and preservation, diagramming, and report writing, including adherence to definitions and detail in the incident narrative with particular focus on human factor causal elements. Standards are developed with the intention to be recognized as the industry standard.

A draft standard, produced by the **Boating Incident Investigation Standard Workgroup** under funding from a U.S. Coast Guard National Nonprofit grant, is now open for public review.

The 30-day public review period closes April 1, 2022. To download a copy of the draft standard, or to submit a comment, visit the Boating Incident Investigation Project on EZ-ESP at https://esp.nasbla.org/esp/. *(Note: For security and standards-development purposes, registration is required to access the Boating Incident Investigation Standard project posted on EZ-ESP. Follow the information posted. No sale or marketing use of registration information is allowed.)*

Contact Matt Majors (matt.majors@nasbla.org) or Pamela Dillon (pam@nasbla.org) if you have questions or would like additional information.