



**National Association of State Boating Law Administrators  
Engineering, Reporting & Analysis Committee**

**Human Factors in Recreational Boating Accident Reporting –  
Consideration of Analysis Strategies – Initial Report (August 2012)**

**THE CHARGE 2012 C-2**

*Examine the quality, consistency, and applicability of the human factors descriptors/data input to BARD by participating states. Identify improvements to their collection and use in assessing which human factors or violations are most likely to result in accidents and fatalities.*

**INTRODUCTION/OVERVIEW**

This charge was developed in support of a National RBS Plan strategy to examine the relevance and use of additional models of accident causation -- especially related to human factors -- for describing fatal recreational boating accidents (2012-2016 Objective 9, Strategy 9.15). It builds on seed work associated with a 2010 ERAC exploration of how to approach and apply data to answering four key boating fatality research questions, one of which was “*what human factors are most likely to result in accidents and fatalities?*”

As is sometimes the case in implementing a charge, however, work plan development, coupled with reviews of related activities, results in a sharpened focus; that proved true for this 2012 assignment. This initial report describes the methodology and work completed to date by the charge team on two components of what is emerging as a multi-faceted approach to the human factors topic, and what is being proposed as a multi-year effort.

The two components addressed in this report are: 1) the improvement to data collection relevant to human factors, and 2) the development of innovative models to explore human factors involved in recreational boating accidents.

For reference, an extensive list of books, papers, reports, and other resources regarding human factors – as used by the charge team in developing this work – can be found in **Appendix A**.

## IMPROVEMENT TO DATA COLLECTION RELEVANT TO HUMAN FACTORS

### BACKGROUND

The U.S. Coast Guard Boating Accident Report (BAR) form has been revised over time to enable the recording of more accurate and relevant descriptions of recreational boating accidents and factors associated with them. Currently, around 30 possible “contributing factors” to a boating accident are listed and several relate to human factors, including, but not limited to alcohol or drug use, operator inattention, and improper lookout.

A number of years ago, however, recognizing the need to include more human factors information in the Boating Accident Report Database (BARD) for analysis purposes, the Coast Guard and NASBLA personnel developed a larger list of possible human errors or violations thought to be applicable to boating accidents. They are **not** data fields on the BAR form. Rather, these items related to human errors or violations are entered into BARD under a special data tab on a voluntary, but highly encouraged basis, by participating states in the course of investigation of a particular incident.

**Appendix B** of this report contains the current list of 69 specific errors or violations that are possible descriptors of human errors or violations for entry into BARD; more than one factor may be applicable to any given accident. The list is similar to one that was developed and analyzed by McKnight *et al.* (2007) and may have evolved around the same time.

The descriptors list in BARD contains a number of specific errors and some implicit grouping of them (for example, ability, alcohol, navigation, and maintenance). In this ERAC 2012 charge work, three key points were identified as relevant to the review of these existing human error descriptors:

1. ***For the most part, these descriptors supply candidate answers to “what” rather than “why” questions.*** For example, there are several entries related to “lookout” and that relate to particular failures, but none as to why these failures might have occurred (for example, complacency, distraction, fixation with another problem in the boat, etc.).
2. ***Is there a better basis for describing contributing factors for accidents that can be developed?*** And on that basis, should *that* list be amended (or should another list be added) to get at the “why” as well as the “what” questions? Are the “what” questions adequate at our present level of development?
3. ***The candidate causes or contributing factors related to what are often termed preconditions for unsafe acts (and more specifically condition of individuals) are limited to alcohol and drugs.*** Although alcohol and drugs are known causes or contributing factors to boating accidents, this list of possible *preconditions for unsafe acts* is far from complete. For example, fatigue is omitted from the list of descriptors even though numerous studies have indicated that fatigue<sup>1</sup> can have many of the same debilitating effects as alcohol or drug use.

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<sup>1</sup> For a discussion of the effects of fatigue on driving, see [http://ec.europa.eu/transport/wcm/road\\_safety/erso/knowledge/Content/55\\_fatigue/effects\\_of\\_fatigue\\_on\\_driving.htm](http://ec.europa.eu/transport/wcm/road_safety/erso/knowledge/Content/55_fatigue/effects_of_fatigue_on_driving.htm), <http://monash.us/muarc/reports/papers/fatigue.html>, or <http://www.rospa.com/RoadSafety/info/fatigue.pdf>. For effects on aviators, see [http://aeromedical.org/Articles/Pilot\\_Fatigue.html](http://aeromedical.org/Articles/Pilot_Fatigue.html), <http://medind.nic.in/iab/t03/i1/iabt03i1p30.pdf>, or

Regarding the first point, the following questions became relevant to the charge team assigned to this work:

- Is the human errors descriptors list clear and understandable? Do we expect and can we achieve consistent and accurate coding? (for example, through a more extensive glossary or manual with specific definitions and examples for this purpose).
- Is the current descriptors list reasonably complete? Should other “what” questions be added to the list?

Regarding the second point relevant to the review of these 69 human factors descriptors, the charge team leader identified that several researchers already had developed descriptors for the analysis of aviation and vessel acts. One such system, the Human Factors Analysis and Classification System, HFACS, was pinpointed as having possible and particular merit, and as potentially being able to address the third point relevant to this review – identifying the *preconditions for unsafe acts*.

## METHODOLOGY

The team assigned to this 2012 charge began its work in coordination with another ERAC charge team that had already been working on proposals to revise five categories of accident reporting terms and definitions, including accident contributing factors. The coordination and cross-checking between teams was in an attempt to integrate into accident descriptors what is already known about human factors so that a more accurate description of accident causes/contributing factors could be developed.

The objectives at that stage of the work were to:

- To ensure that the accident descriptors could be tied into human factors lapses (for example, errors [perception, skills, decision making], violations, conditions for unsafe acts, error producing conditions, violation producing conditions);
- To evaluate whether or not more sophisticated causal descriptors could reliably be developed and used by existing personnel;
- To recommend, if appropriate, revisions to the list of 69 human factors descriptions in use, including development of a set of more detailed definitions of terms; and
- To test the revised list on a sample of accidents.

## OUTCOMES

The charge team concluded that merging the existing list of human factors with the revised list of contributing factors proposed by the team working on the report terms and definitions would be the most reasonable route. With the additions and modifications to the contributing factors list, all of the original human error descriptors were able to be mapped to a contributing factor(s) or to a “distraction code(s)” associated with one of the factors in the revised list.

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[http://www.nts.gov/Recs/mostwanted/aviation\\_reduce\\_acc\\_inc\\_humanfatig.htm](http://www.nts.gov/Recs/mostwanted/aviation_reduce_acc_inc_humanfatig.htm). For a discussion of effects of fatigue in marine accidents, see <http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA323392> or [http://www.amsa.gov.au/shipping\\_safety/coastal\\_pilotage/fatigue\\_study\\_on\\_coastal\\_pilots/The\\_work\\_practices\\_of\\_Marine\\_Pilots/Pilot\\_Work\\_Practices-Results\\_3.asp](http://www.amsa.gov.au/shipping_safety/coastal_pilotage/fatigue_study_on_coastal_pilots/The_work_practices_of_Marine_Pilots/Pilot_Work_Practices-Results_3.asp).

The team then shifted its emphasis to exploring the data that would be captured by the revised contributing factor list and trying to imbed this list into a framework that would get at the second component of this charge – the development of innovative models to explore human factors involved in recreational boating accident reporting.

## DEVELOPMENT OF INNOVATIVE MODELS TO EXPLORE HUMAN FACTORS

### BACKGROUND

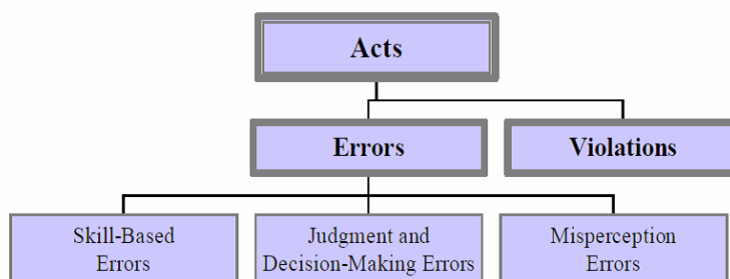
The charge team began discussions on this component of its 2012 work with consideration of a framework suggested originally by the Department of Defense (DOD) in its version of the previously-mentioned “HFACS” used to analyze aviation and commercial shipping human factors.

A review of the literature revealed most investigators of accidents in fields including aviation (where much of the original work was done), commercial shipping, industrial accidents (particularly chemical and nuclear facilities), and highway and rail accidents, have concluded that the majority of causes or contributing factors to accidents relate to human failures. That suggested it would be very likely that human factors are a major cause or contributing factor to recreational boating accidents. As the team already has discovered, it might not be easy to develop ways to analyze human factors in recreational boating accidents, but the challenge would need to be overcome in order to even more effectively address the underlying causes and contributors in these accidents.

The DOD HFACS system is a four-tier system consisting of **unsafe acts** (including errors and violations) at the bottom of the pyramid (proximate causes), followed by **preconditions for unsafe acts**, **supervision**, and **organizational influences** in ascending order on the pyramid. The **supervision** and **organizational influences** levels do not appear to be directly applicable to recreational boating accidents. As a result, the team decided to limit the focus of the charge work to **unsafe acts** and **preconditions for unsafe acts**.

### BRIEF REVIEW OF ‘UNSAFE ACTS’

According to the DOD HFACS taxonomy, **unsafe acts include errors** (further subdivided into errors of perception, skill-based errors, and decision errors) **and violations** (of Navigation Rules in the case of boating accidents).



The DOD HFACS document defines these terms as follows:

**“Errors:** Errors are factors in an accident<sup>2</sup> when mental or physical activities of the operator fail to achieve their intended outcome as a result of skill-based, perceptual, or judgment and decision making errors, leading to an unsafe situation. Errors are unintended. Errors are classified into three types: *Skill-Based, Judgment and Decision Making*, and *Misperception Errors*. Using this error analysis process, the investigator must first determine if an individual or team committed an active failure.<sup>3</sup> If so, the investigator must then decide if an error or violation occurred. Once this is done, the investigator can further define the error.

**“Skill-based Errors:** Skill based errors are factors in an accident when errors occur in the operator’s execution of a routine, highly practiced task relating to procedure, training or proficiency and result in an unsafe situation. Skill-based Errors are unintended behaviors.

**“Judgment and Decision Making Errors:** Judgment and Decision making errors are factors in an accident when behavior or actions of the individual proceed as intended yet the chosen plan proves inadequate to achieve the desired end-state and results in an unsafe situation.

**“Misperception Errors:** Misperception errors are factors in an accident when misperception of an object, threat or situation (such as visual, auditory, proprioceptive,<sup>4</sup> or vestibular illusions,<sup>5</sup> cognitive or attention failures) results in human error.

**“Violations:** Violations are factors in an accident when the actions of the operator represent willful disregard for rules and instructions and lead to an unsafe situation. Unlike errors, violations are deliberate.”

These categories are not mutually exclusive; that is, an **unsafe act** may include more than one type of error (for example, both a perceptual and decision-based error). As used in the DOD taxonomy, violations pertain to deliberate acts when the operator (or members of the crew) willfully disregards

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<sup>2</sup> The document uses the word ‘mishap.’ To avoid confusion, ‘accident’ has been substituted.

<sup>3</sup> According to psychologists studying accidents and as discussed in the DOD HFACS guidance ‘*active failures* are the actions or inactions of operators that are believed to cause the accident. Traditionally referred to as ‘error’, they are the last ‘acts’ committed by individuals, often with immediate and tragic consequences. For example, an aviator forgetting to lower the landing gear before touch down or showing off through a box canyon will yield relatively immediate, and potentially grave, consequences. In contrast, *latent failures* or *conditions* are errors that exist within the organization or elsewhere in the supervisory chain of command that affect the tragic sequence of events characteristic of an accident. For example, it is not difficult to understand how tasking crews or teams at the expense of quality crew rest can lead to fatigue and ultimately errors (active failures) in the cockpit.’

<sup>4</sup> Pertaining to proprioception or the awareness of posture, movement, and changes in equilibrium and the knowledge of position, weight, and resistance of objects as they relate to the body.

<sup>5</sup> Illusions involving the semicircular and somatogyral canals of the vestibular system of the ear occur primarily under conditions of unreliable or unavailable external visual references and result in false sensations of rotation. These include the leans, the graveyard spin and spiral, and the coriolis illusion. Neither Proprioceptive nor vestibular failures are directly applicable to recreational boats under most circumstances. Thus, it is appropriate to reword the definition of misperception errors to read ‘Misperception errors are factors in an accident when misperception of an object, threat, or situation results in human error.’ The distraction codes mentioned on page 5 of this report and associated with one of the revised contributing factors provide several examples of misperception errors.

rules. The implicit assumption is that operators (or crew) have knowledge of the applicable rules. This assumption may not always be valid for operators of recreational boats.

**Unsafe acts** as a broad category translates directly in terms of recreational boating accidents and, as such, the charge team recommends that the active failures category be used directly (keeping in mind that violations are further subdivided into deliberate and inadvertent violations). The contributing factors revisions proposed by the ERAC charge team addressing report terms and definitions can be used directly in the HFACS **unsafe acts** typology.<sup>6</sup> For example:

- **Under the HFACS definitions of violations, the following are potentially applicable:** Navigation Rules-related violations, alcohol, certain drugs.
- **Under the HFACS definitions of perceptual errors, the following factors are potentially applicable:** Improper Lookout/Inattention. Several of the associated distraction codes for this factor also are applicable to perceptual errors.
- **Under the HFACS definitions of decision or judgment errors, the following factors are potentially applicable:** Speed too fast for conditions, failure to maintain safe distance, failure to take adequate evasive action (which might also fall under skill-based errors), sharp turn (might also fall under skill-based errors), improper loading, overloading.
- **Under the HFACS definitions of skill-based errors, the following factors are potentially applicable:** Sharp turn, failure to take adequate evasive action, occupant behavior, Person(s) in area not intended for occupancy, towed watersport participant behavior, improper anchoring, improper loading, overloading, off throttle loss of steering, starting in gear, dam/lock, failure to ventilate, and possibly carbon monoxide.

Some of the entries in the revised contributing factors list that cover mechanical issues (for example, equipment failure, hull failure, and machinery failure) might also relate to human factors through lack of maintenance, as one example; but the charge team recommends that these factors be included solely among mechanical causes for the present and not be included in the initial human factors analysis.

At this time, the team feels confident that the broad category of **unsafe acts** can be used effectively as a way to help explain the role of human factors as causes or contributing factors to recreational boating accidents. The list of contributing factors proposals developed as part of the report terms and definitions work is expected to be satisfactory for this purpose.<sup>7</sup>

**Preconditions for unsafe acts**, briefly discussed next, are also important to address, but this is likely to be a more difficult task. The challenge is developing a categorization scheme that is accurate, informative, and capable of being implemented by present personnel (perhaps with additional training).

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<sup>6</sup> See [www.nasbla.org/terms](http://www.nasbla.org/terms) for a download of the file “ERAC USCG Contributing Factors list\_rev Aug 2012.pdf,” which contains the recommended list as of August 2012.

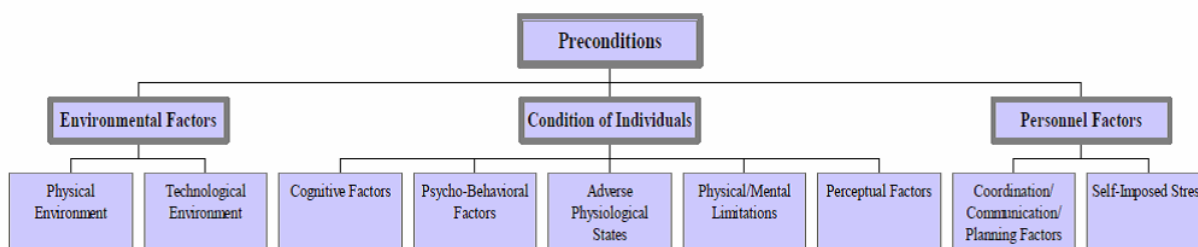
<sup>7</sup> This is not to say that everyone analyzing a case will reach identical conclusions. Some of the categorizations will be judgment calls.

## BRIEF REVIEW OF 'PRECONDITIONS FOR UNSAFE ACTS'

According to the definition in the DOD HFACS guide:

"Preconditions are factors in an accident if active and/or latent preconditions such as conditions of the operators, environmental or personnel factors affect practices, conditions or actions of individuals and result in human error or an unsafe situation... In this error analysis model preconditions include *Environmental Factors*, *Condition of the Individuals* and *Personnel Factors*."

The DOD guidance document provides a typology of **preconditions for unsafe acts** as shown in the illustration below.



The DOD HFACS documentation defines each of the factors included in the three broad categories of environmental factors, condition of the individuals, and personnel factors. Inspection of the detailed lists of factors within each of the broad categories, however, revealed that many are more directly applicable to aviation than to recreational boating; moreover, inspection further revealed that it likely would not be possible -- in the investigation of a typical recreational boating accident -- to be able to collect the data required to fully support this level of analysis (although data might be available in certain cases). Nonetheless, the idea of **preconditions for unsafe acts** is valid, and the charge team recommends creation of a simplified list of preconditions that 1) captures many of the relevant ideas; 2) is directly applicable to recreational boating accidents; and 3) might fit into the revised contributing factors list developed by charge team addressing the report terms and definitions. This modified version of HFACS is being referred to as "HFACS-Lite" by the charge team.

To begin, the three broad categories of **preconditions** (environmental factors, condition of individuals, and personnel factors) appear reasonable. Necessary or appropriate modifications to create "HFACS-Lite" relate to some of the factors within these categories, and they are discussed below. The charge team suggests that these factors be grouped into two broad categories, **environmental factors** and **condition of individuals**, with sub-categories within each.

### ENVIRONMENTAL FACTORS

According to the DOD HFACS taxonomy, **environmental factors** are defined as follows:

**"Environmental Factors:** Environmental factors are factors in an accident if *physical* or *technological* factors affect practices, conditions and actions of an individual and result in human error or an unsafe situation. Environmental factors include:

**Physical Environment:** Factors in an accident if environmental phenomena such as weather, climate, white-out or dust-out conditions affect the actions of individuals and result in human error or an unsafe situation.

**Technological Environment:** Factors in an accident when cockpit/vehicle/workspace design factors or automation affect the actions of individuals and result in human error or an unsafe situation.”

With minor modifications, these can be used directly, and they are addressed in the contributing factor revisions that have been developed by the ERAC charge team working on the report terms and definitions. There is clear alignment with regard to “physical environment” -- for example, restricted visibility (environmental), congested waters, hazardous waters, wake, and weather. The revised contributing factors that most closely match “technological environment” are restricted visibility - vessel related and “glare from lights onboard the vessel” (one of the distraction codes proposed for the revised factor improper lookout/inattention).

## CONDITION OF INDIVIDUALS

Under the DOD category of *condition of individuals* are several sub-categories including cognitive factors, psycho-behavioral factors, adverse physiological states, physical/mental limitations, and perceptual factors. Included under *personnel factors* (which the team recommends be gathered under this broad grouping) are coordination/communication planning factors and self-imposed stress.

Although these sub-categories have proven useful for analyzing aircraft accidents, not all are relevant to recreational boating accidents; moreover, some conditions require data that are unlikely to be readily observable by investigators of recreational boating accidents. This is where simplification to create an “HFACS-Lite” becomes more clearly appropriate. The charge team recommends simplification of these categories into the following conditions of individuals:

**Adverse physiological states:** Included within this sub-category would be 1) use of alcohol or illegal drugs, 2) use of prescription or legitimate over-the-counter drugs that may impair performance,<sup>8</sup> 3) fatigue, 4) lack of or failure to use corrective aids (for example, glasses or hearing aids), 5) pre-existing physical illness/injury, and 6) motion sickness. Several of these categories have been captured under the proposed revisions to the contributing factors list (for example, alcohol, drugs, medical condition), but the charge team is considering whether it might be appropriate to add a few terms—specifically, fatigue – if initial analysis deems it beneficial. Fatigue has been extensively studied as a cause of accidents in other transportation modes (general and commercial aviation, personal and commercial motor vehicle operation, and commercial shipping), but much less has been done on fatigue as a contributing factor in recreational boating accidents.

**Psycho-behavioral factors:** Included within this sub-category would be 1) over-aggressive behavior, 2) complacency, 3) emotional state/stress, and 4) perceived pressures to complete

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<sup>8</sup> See [http://www.faa.gov/library/manuals/aviation/pilot\\_handbook/media/PHAK%20-%20Chapter%2016.pdf](http://www.faa.gov/library/manuals/aviation/pilot_handbook/media/PHAK%20-%20Chapter%2016.pdf), [http://www.skybrary.aero/index.php/Lifestyle\\_and\\_Adverse\\_Performance\\_Effects\\_\(OGHFA\\_BN\)](http://www.skybrary.aero/index.php/Lifestyle_and_Adverse_Performance_Effects_(OGHFA_BN)), and [http://www.pilotfriend.com/training/flight\\_training/human/drugs\\_etc.htm](http://www.pilotfriend.com/training/flight_training/human/drugs_etc.htm) for more information on the effects of various legitimate drugs.



mission/voyage resulting from expectations of passengers or crew. This category is relevant, but difficult to assess and best left aside for now.

**Knowledge or experience factors:** It might be difficult to distinguish between lack of knowledge and lack of experience, but this is a potentially important distinction.<sup>9</sup> For the present, this information is captured by the contributing factor operator inexperience.

## METHODOLOGY

With “HFACS-Lite” in mind, and as of August 2012, the charge team has begun preliminary work toward applying the model to a sample of five cases to determine its utility. These five cases have already been investigated and accident reports have been completed:

- Two recreational vessel collision cases provided by the Tennessee Wildlife Resources Agency (cases no. 083173 and 053139).
- Capsizing of US small vessel *Taki-Too*, Tillamook Bay Inlet, Oregon as described in the NTSB Report NTSB/MAR-05/02.
- Collision of unnamed recreational vessel with uninspected towing vessel Little Man II. Two reports are available for this case, one from the NTSB and another from the Florida Fish and Wildlife Conservation Commission.
- Grounding of the tankship *World Prodigy* 23 June 1991 as described in the NTSB Report NTSB/MAR-91/01. This is a commercial ship accident, but one where fatigue was directly addressed and is of interest for this reason.

The charge team will be applying the following set of questions to analyze the effectiveness and utility of the “HFACS-Lite” model:

### Unsafe Acts

- **Violations:** What violations did you detect? -Is it possible to determine whether these were deliberate or inadvertent from the material presented in the case?
- **Errors:**
  - **Perceptual errors:** What errors were you able to identify that you would classify as perceptual errors? Are there applicable distraction codes?
  - **Skill based errors:** What errors were you able to identify that you would classify as skills based errors?
  - **Decision errors:** What errors were you able to identify that you would classify as decision errors?

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<sup>9</sup> This distinction is typically not made in commercial accident investigations, perhaps because it is assumed that commercial operators have adequate training and knowledge. Nonetheless, some commercial accident investigations (e.g., the case of the passenger vessel *Finest* see <http://www.nts.gov/doclib/reports/2002/MAR0203.pdf>) do address gaps in knowledge and training.

## Preconditions for Unsafe Acts

- **Environmental:**
  - **Physical environmental:** What factors in an accident, related to environmental phenomena such as weather, climate, white-out or dust-out conditions, appeared to affect the actions of individuals and result in human error or an unsafe situation?
  - **Technological Environment:** What (if any) factors in the technological environment (for example, cockpit/vehicle/workspace design factors or automation) might have affected the actions of individuals and resulted in human error or an unsafe situation?
- **Adverse physiological States:** Was there any evidence of 1) use of alcohol or illegal drugs, 2) use of prescription or legitimate over-the-counter drugs that may impair performance, 3) fatigue, 4) lack of or failure to use corrective aids (for example, glasses or hearing aids), 5) pre-existing physical illness/injury, and 6) motion sickness?

The charge team will use the proposed revisions to the contributing factor terminology to complete this task thereby also testing the efficacy of these terms and definitions in the area of human factors (see [www.nasbla.org/terms](http://www.nasbla.org/terms) for a download of the file “ERAC USCG Contributing Factors list\_rev Aug 2012.pdf,” which contains the recommended list as of August 2012).

## OUTCOMES

The findings from the accident review process described above will be used to inform the next steps for continuing work on this topic during the FY 2013 committee cycle.

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## APPENDIX B

*Descriptors of human errors or violations used for entry into BARD under separate tab*

1. **Ability: Operator**—Setting out with an operator who clearly does not possess the ability needed for handling crew responsibilities, including sails, docking, and emergencies.
2. **Ability: Others**—Not making sure that passengers and crew possess the ability needed to avoid risk in the intended operation.
3. **Alcohol: Operator**—Becoming impaired by alcoholic beverages or certain drugs.
4. **Anchor: Preparation**—Not having the anchor ready to lower in the right manner.
5. **Anchor: Type**—Using inadequate ground tackle for the weather likely to be encountered (anchor of correct size and type and with adequate scope to prevent breakaway).
6. **Anchor: Use**—Not anchoring correctly, including lack of enough scope for wind.
7. **Cannot identify error from information provided.**
8. **Capsized/swamped**—Not remaining with the boat when capsized or swamped, or using the boat for flotation.
9. **Control: Activities**—Deliberate wave jumping or spraying, resulting in loss of control, falling from or striking vessel.
10. **Control: Balance**—Lack of proper steering, sail handling, or weight distribution to maintain balance.
11. **Control: Maneuvering**—Failing to maneuver properly in tight quarters, e.g. docking, anchoring, coming alongside other vessels, negotiating obstructions or clearing away from such situations.
12. **Control: Power**—Loss of steering because of power reduction e.g. jet propulsion.
13. **Control: Turning**—Turning too sharply and falling from or losing control of vessel (e.g. PWC).
14. **Control: Wind/waves/current**—Losing control in heavy wind or waves or strong current, resulting in fall or collision.

**15. Distance: Land/structures—Keeping insufficient distance from land, shallow water, and structures such as docks, rocks, navigational aids.**

**16. Distance: Other boats—Not keeping insufficient distance from other boats to allow for wind, wave action, or other conditions that might result in collision.**

**17. Error not on list, enter description.**

**18. Give way: Collision—Failing to give way to avoid a collision.**

**19. Give way: Right-of-way—Failing to yield to a vessel with the right-of-way.**

**20. Loading: Distribution—Allowing passengers/gear to be positioned in a way that reduces the stability of the boat, increases the chances of swamping/ capsizing, or obstructs the operator's view.**

**21. Loading: Fuel—Handling fuel in a manner that can cause combustion or spill.**

**22. Loading: Weight—Carrying too many passengers and/or too much gear for the size of the boat, sea conditions and weather.**

**23. Location: Check—Not checking the intended location of operation in advance for hazardous conditions, including rapids, strong currents, waterfalls, low-head dams, or underwater obstructions.**

**24. Location: Hazards—Operating in areas known to be hazardous to the particular type of vessel, including rapids, low-head dams, underwater obstructions, breaking swells.**

**25. Lookout: Ahead—Being distracted and not looking ahead or paying sufficient attention to boats and other obstructions in the intended path.**

**26. Lookout: Course change—Failing to look along the intended path of travel before initiating a turn.**

**27. Lookout: Depth—Underway without visually checking depth of water often enough.**

**28. Lookout: Gear—Failing to look out for swing of the boom or other items of gear that can cause injury.**

**29. Lookout: Night—Not locating/detecting unlighted objects (or flashing marks) in or near the intended course through use of searchlight, binoculars, radar, etc.**



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**30. Lookout: Obstructed—Failing to take steps to overcome vision obstructions e.g. sails, boat structures, other boats, passengers, sun glare or spray.**

**31. Lookout: Small objects—Not looking closely for small objects or people in the water where they are likely to be present.**

**32. Lookout: Surveillance—Not exercising all-round surveillance for boats that may be approaching.**

**33. Maintenance: Check fumes—Starting the engine without first operating a bilge blower and sniffing for presence of fuel vapors.**

**34. Maintenance: Controls—Operating with controls (steering, trim plate, throttle, shift, outboard or stern drive trim) in need of repair/adjustment or fitted with wrong replacement parts.**

**35. Maintenance: Engine—Operating with propulsion system that has become unreliable for lack of maintenance (engine doesn't start or stalls, weak battery, power loss, etc).**

**36. Maintenance: Fuel system—Failing to detect leaking fuel distribution lines (engine, stove heating) through periodic inspection /testing.**

**37. Maintenance: Hull—Not making sure the hull is free of leaks or other opportunities for entry of water.**

**38. Maintenance: Lines—Failing to assure that the boat is equipped with serviceable lines (dock, anchor, tow).**

**39. Maintenance: Rigging—Failing to assure proper maintenance of rigging, including shrouds, lines to prevent failure and damage to boat.**

**40. Navigation: Aids—Not using navigational aids adequately to determine position or course relative to shallow water and hazards, including land, jetties, etc.**

**41. Navigation: Current—Failing to account for current in terms of available propulsion, degree of control, and ability.**

**42. No Error**

**43. PFD: Availability—Not having the required number and type of PFDs (e.g. wearable, throwable, and children's) readily available.**

**44. PFD: Non-swimmers—Not requiring occupants unable to swim and exposed to any risk of immersion to wear a PFD.**

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**45. PFD: Risk of hypothermia—Not wearing PFD when cold water would jeopardize the chances of remaining afloat.**

**46. PFD: Risk of immersion—Not wearing PFD when conditions create significant risk of immersion, including rapids, dams, rough water, working outside rails, and impaired passengers.**

**47. Protective clothing—Not having or wearing clothing appropriate to the elements, e.g. cold air or water.**

**48. Speed: Maneuvers—Attempting maneuvers at a higher speed than the operator can safely manage, including when approaching another boat, dock or other structure.**

**49. Speed: Obstructions—Operating at too high a speed in close proximity to obstructions, including land, docks, or moored vessels.**

**50. Speed: Other boats—Operating at too high a speed in proximity to other boats, including activities involving games with other PWCs.**

**51. Speed: Reduced visibility—Moving too fast for the limitations of night or other forms of reduced visibility.**

**52. Speed: Turns—Attempting a turn at too high a speed, resulting in loss of control, capsize, or swamping.**

**53. Speed: Waves/wake—Attempting to navigate through waves or wake at too great a speed for wave size.**

**54. Stability: Boat—Committing acts that jeopardize stability and result in capsize, including standing, leaning, reaching or hanging over the side, shifting weight abruptly, not trimming the boat properly for the operation.**

**55. Stability: Occupant—Not keeping a firm grip on the boat; standing in the boat, sitting on seat backs or other locations that invite being thrown off.**

**56. Swimming: Flotation—Not using some form of flotation when entering the water with inadequate swimming ability.**

**57. Swimming: Off/on—Not having a safe method to get off and re-board the boat by those voluntarily entering the water (e.g., to swim or ski).**

**58. Vessel Suitability—Using a vessel with design characteristics (type, length, etc) basically unsuited to the intended operation.**

**59. Waterskiing: Procedures—Towing water skiers, tubes and other devices unsafely or permitting unsafe practices (e.g., wave jumping).**

**60. Waterskiing: Recovery—Not keeping boat clear of skiers in the water in the process of recovery.**

**61. Weather: Ability—Setting out under weather conditions that are beyond the operator's experience.**

**62. Weather: Handling—Not responding appropriately to rough wind/water conditions through safe handling.**

**63. Weather: Operation—Operating in wind and/or wave conditions that are clearly unsafe for the type of boat, including canoes and kayaks, and rowboats.**

**64. Weather: Recognition—Not recognizing conditions that are too severe for safe operation.**

**65. Weather: Security—Not remaining in a secure place aboard in rough weather.**

**66. Weather: Shelter—Not seeking shelter from rough conditions once they become clearly dangerous.**

**67. Weather: Shorten sail—Not shortening or lowering sails when wind conditions warrant.**

**68. Weather: Spill wind—Not watching for gusts and spilling the wind to avoid extreme heel, capsize, or loss of control.**

**69. Weather: Visibility—Not checking forecasts for conditions that make operation unsafe.**