USER MANUAL: TANKER

RAPID RESPONSE DAMAGE ASSESSMENT
2024

Contents

Revision History

Date of Revision	Detail of Revision	Approved
September 25, 2019	Added Copyright reference to front page.	RH
	Added note on Page 4 about changes to vessels principal characteristics.	RH
January 10, 2024	Update	FT

If you need Emergency Stability and Strength Analyses, call RRDA now at +1 (281) 872-6161 and email the most recent loading computer output to RRDA@eagle.org.

- All pages of the output should be sent.
- State the voyage number.
- State date and time of the condition.
- Note fuel burn and any other significant revisions to the condition.

Note regarding changes to the principal characteristics of the vessel:

Any changes made to the vessel that revises lightship, hydrostatic particulars or hull strength, must be communicated to RRDA@eagle.org for consideration. For example, a tanker conversion to FPSO or an added mid-body section to a container ship. Other conversions apply.

SECTION

1

RRDA Program

1.1 General Information

RRDA maintains a website to provide access to the latest RRDA User Manual and other related documents. The page is found at the following link:

https://ww2.eagle.org/en/Products-and-Services/rapid-response.html

RRDA complies with the following regulations and industry guidelines:

- MARPOL Annex I, Regulation 37.4, as circulated by resolution MEPC.117(52) states that all oil tankers of 5,000 tons deadweight or more shall have prompt access to computerized shore-based damage stability and residual structural strength calculation programs.
- MARPOL 73/78 Annex I, Regulation 37.1 requires a shipboard oil pollution emergency plan (SOPEP) to be carried onboard for all tankers of 150 gross tons or more and all other vessels of 400 gross tons or more.
- U.S. Coast Guard requirements of OPA 90 in 33 CFR 155.240 for oil tankers and offshore oil barges, in which owners are required to have "prearranged, prompt access to computerized shore-based damage stability and residual structural strength calculations."
- The ISM Code, Section 8, requires the company to establish procedures to respond to potential emergency shipboard situations, including the use of drills and exercises to prepare for emergencies.
- OCIMF Guidelines on Capabilities of Emergency Response Providers.
- IACS Rec. No. 145 Recommendation for the Operation of Shore-Based Emergency Response Services.

The ABS Rapid Response Damage Assessment (RRDA) Program is administered from ABS headquarters in Spring, Texas, USA. The facility provides rapid response damage assessment support during an emergency incident affecting an enrolled vessel's stability and hull strength.

RRDA maintains an agreement with the vessel owner, to provide this service and vessel-specific data for your ship is stored electronically at ABS. This data is provided for responding to an emergency on board. RRDA should be considered an extension of the ship's own shoreside emergency response team capability.

RRDA is activated when the Master or other owner-authorized person calls the RRDA 24-hour emergency number and requests assistance with a vessel emergency incident.

The time required for RRDA to provide accurate analyses for any given scenario affecting stability and strength is dependent on:

1. Receipt of the vessel load condition and damage reports
2. The complexity of the problem

The RRDA Program does not cover salvage engineering, class surveys, or surveys in connection with repairs, damages, conversions, compliance with outstanding recommendations, extensions, lay-up or reactivation, modifications/alterations, riding ship, change of flag or new installations.

When requested by a flag Administration, ABS is obliged to provide details of its evaluations and files. When a vessel is classed or issued with a Load Line by ABS, the ABS Classification department will be advised that the RRDA team is evaluating damage on an ABS-classed or Load Line-only vessel. The ABS RRDA team will review the most recent available survey status for the vessel and will communicate response activity to the ABS Classification department for consideration. However, a survey by the class surveyor continues to be a requirement for subsequent evaluation of damage and repairs or when a Certificate of Fitness to Proceed[1] is to be issued.

ABS does not act as a principal in the matter of salvage or repairs. ABS can only act in an advisory capacity, leaving it to the client to accept or reject any recommendations ABS may make. ABS has no authority to order or contract for repairs, salvage or other matters.

1.2 Instructions for Validating Enrollment Status

This instruction applies to vessels that are ABS classed only.
(Vessels that are not classed with ABS, will be provided an RRDA Certificate valid for 12 months)

This instruction is intended to ensure that Masters, vessel managers and other parties (Port State Control Officers, Vetting Inspectors, etc.), can easily validate whether a vessel is enrolled in the ABS RRDA Program.

There are two means to confirm if a ship is enrolled in RRDA:

1. Examination of the ABS Class Certificate.
   The vessel is enrolled in the RRDA program if the Class Certificate shows “RRDA” in the Additional Notations.
   For example:

   ADDITIONAL NOTATIONS
   RRDA, BWE, CRC(I), TCM, GRAB [20]

2. The Class Record
   Details provided in the ABS Record are available via the internet and provide reference to the RRDA notation as follows:

[1] Class authorization for the ship to transit, issued after recommendations made by the attending surveyor have been completed.

https://ww2.eagle.org/ > Rules and Resources > Databases > ABS Record > Search the Database, Enter vessel name or other search criteria > Search > Click on Vessel found > Scroll to Additional Notations.
For example:

Additional Notations
BWT, CLP-V, CRC(SP), CSC, ENVIRO, IHM, NBL, RRDA, RW, SMART (INF), TCM, UWILD

1.3 Types of Analyses for Response and Drills

Using the RRDA HECSALV™ model for the ship, the following useful analyses can be made:

1. Ground reaction and force to free with allowance for tide
2. Deadweight to be lightered or shifted to refloat
3. Effect on stability due to flooding, grounding, wind heeling, cargo loss or shifting, liquefaction (bulk carriers)
4. Oil outflow
5. Bending and shear stresses caused by pinnacle loads with the ship aground
6. Hull girder strength with wave loading
7. Local strength in the damaged area
8. Evaluation of the plans for offloading, ballasting or cargo transfer
9. Other calculations as appropriate for the vessel's condition
10. Drifting and oil spills using NOAA's WebGNOME web application

1.4 Drills

Knowledge about the RRDA program may be improved with regular drill activity. Drills establish mutual expectations and promote a more efficient response should an actual incident occur.

Vessel managers usually exercise their response capability annually and invite RRDA to participate at the appropriate level. Drills may connect the ship directly with RRDA, but it is more common for RRDA to communicate with the ship manager DPA/response team ashore, who relays relevant information to and from the vessel. This relieves the Master of the need to duplicate calls and ensures all parties are using the most current information. (This is most relevant in an actual response)

RRDA's capacity for response may be tested at any time and to the extent the vessel manager deems appropriate. However, general arrangement of drill activity is subject to the following contingencies:

1. Notification is given to RRDA by email (RRDA@eagle.org), with at least one week notice.
2. Any charges to be incurred by the vessel manager are agreed in advance.
3. RRDA may decline a proposed drill time if the drill activity conflicts with other scheduled drill activities previously agreed to by RRDA.
4. RRDA may cease drill activities if RRDA is activated for an actual ship incident.

The extent that RRDA is involved in a drill can vary depending on the operator's requirement. RRDA involvement could include:

1. Live drill role play. RRDA is activated and provides analysis reports and recommendations according to the scenario and information provided by the operator. This tests RRDA's capacity to respond.
2. Pre-drill analyses. RRDA contributes to a drill scenario developed by the operator, providing accurate input data with respect to how the ship will react to a grounding or collision or other serious event. This is done in advance and allows the operator to script a scenario and use RRDA's reports to inject accurate results. For the operator, this validates that RRDA has an accurate model of the ship and that effective analyses can be completed and reports generated.
3. Post-drill reporting. RRDA is requested to provide analyses reports after a drill is completed, using data provided by the operator. This will validate that RRDA has an accurate model of the ship and can provide analyses of the conditions communicated by the operator.
4. Communication drill. Ship or management office calls RRDA's emergency number for a communication drill. This validates the number is correct and that RRDA can be activated. This is done by speaking with RRDA staff directly or, if after normal office hours, by speaking with an RRDA call center operator.

All drill activity is logged with RRDA.

1.5 Training

RRDA offers short training sessions that can be delivered remotely via the Web or by office visit. Contact RRDA@eagle.org for details.

SECTION

2

Communications

2.1 Activating/Notifying RRDA Team

To activate the ABS RRDA team, the client is to establish verbal communication using the phone numbers provided below. RRDA is most commonly contacted by the Designated Person Ashore (DPA) but may also be contacted directly by the vessel Master.

MOST IMPORTANT: Do not attempt to initiate an RRDA response using email only.

24-hour Emergency Numbers:
Primary: +1 (281) 872-6161
Alternate: +1 (281) 820-8697

For Consideration.

1. Do not collect all the information before calling. Initiate contact with RRDA immediately and provide additional information when it is available.
2. Always establish verbal communication with RRDA first. RRDA email is monitored during normal office hours only so email communications received after normal office hours will probably not connect to RRDA personnel within the time needed for an effective emergency response.

2.2 Time to Respond

The RRDA team will respond immediately to calls received during office hours. After office hours and during weekends or holidays, your call will be taken by a call center representative who will then alert RRDA and relay message details. This process is expected to take about 30 minutes or less. An RRDA Team Leader will call you back using the contact details given, and when it is confirmed that the RRDA team is required, the Team Lead and other staff will immediately travel to the RRDA facility. It is expected that RRDA will arrive at the office within two hours after the initial call is made.

2.3 Office Hours

During these normal office hours, as listed below, a member of the ABS RRDA team can be expected to answer the incoming call directly. If personnel are temporarily unavailable, the line will automatically transfer to a call center operator who will take note of critical details and then relay that information to RRDA personnel directly.

Monday through Friday 7:30 a.m. to 4:30 p.m. (0730 to 1630) – Central U.S. Time

Note: Non-emergency inquiries relating to RRDA are welcomed by phone or email. Such inquiries should be made by email (RRDA@eagle.org) or using the ABS main number (+1 (281) 877-6000).

2.4 After Office Hours

After office hours and during holidays, any emergency call directed to RRDA using the +1 (281) 872-6161 and the +1 (281) 820-8697 numbers will be answered by the ABS RRDA call center. The caller will be asked for a contact name, vessel name and IMO number, call back number and nature of the incident. The call center operator will then connect directly with RRDA personnel to initiate the RRDA response and you will be called by the RRDA Team Leader directly thereafter.

2.5 Action After Voice Notification

After the initial phone contact has been established and RRDA activation is confirmed, an email documenting the vessel status should be sent to RRDA.

Email: RRDA@eagle.org

FOR INFORMATION NEEDED BY RRDA, GO TO Section 4.

SECTION

3

Information Sharing

3.1 Information Requirements

Emergency protocols are not prescriptive. In an emergency, phone conversations and email exchanges with RRDA will establish the mutual communications and information requirement that is relevant to the incident. Priority of information required by RRDA will be discussed with respect to the specifics of the incident. Effort will always be made to ensure that information requested from the vessel is important and relevant to the requirement. Early and transparent sharing of information is key.

FOR INFORMATION NEEDED BY RRDA, GO TO Section 4.

3.2 Load Condition Before the Incident

MOST IMPORTANT!

The vessel's loaded condition must be provided to RRDA. Without this information, analysis results will be unreliable.

The load condition should be sent to RRDA as output from your loading computer with corrections offered as appropriate for bunkers or other significant changes such as ballast. If your system includes CARGOMAX software (a brand of loading computer), the exported load-case (.LC) file should be sent to RRDA. If the loading computer is other than CARGOMAX, a full PDF of the output is preferred.

3.2.1 Departure Load Condition

You are encouraged to routinely send RRDA the departure load condition report so that it can be used by RRDA in an emergency. This will do away with the need for the condition to be sent by the vessel or manager during an emergency incident but, to ensure that no error occurs, the Voyage Number and departure port with date must be clearly identified in the report.

3.3 Collision/Damage/Flooding (Not a Grounding Event)

The goals of RRDA are to identify the resulting damaged state, to maintain stability, monitor hull stress and to consider limiting pollution. The focus following a significant collision event is the prevention or reduction of oil outflow from cargo and fuel oil tanks which can result from local or global structural losses.

FOR INFORMATION NEEDED BY RRDA, GO TO Section 4.

3.3.1 Collision Management and Considerations

a. Ingress should be prevented or otherwise managed to the extent possible. This is particularly true for machinery spaces vital to the function of the vessel. Even so, there are circumstances, such as flooding of a ballast tank for example, that seawater ingress will not make the ship more vulnerable to failure and, depending on design and loads, might actually reduce global or local stress surrounding the damage.
b. Unless it is clear that pumps are incapable of improving the ingress rate, pumping should continue, at least until adequate assessment has been made and alternate recommendations have been considered.
c. Because the pressure differential reduces as balance occurs, the rate of seawater ingress will decrease as the water depth in the space increases. Therefore, the pumping capacity to discharge a flooded space may not be adequate to prevent initial flooding, but the same capacity might prevent the space from becoming fully flooded as the ingress rate slows. This may be of no concern or advantage for tank spaces that can be allowed to flood completely, but in machinery spaces, limiting ingress to the lowest possible height will be critical. Also, depending on pump type, the added pressure at the inlet may increase the pump's efficiency as the water level rises.
d. For spaces well outside the parallel mid-body and with significant flare in the hull shape such, as an aft engine room, internal volume varies considerably dependent on the height above the tank top. Therefore, with a steady ingress flow, the rate at which the water depth rises will slow as flooding progresses. Considering this, be aware that the time it will take to flood the compartment should not be estimated based on the initial rate at which the water level rises, unless the space is wall-sided.
e. If the engine room is flooding and is located toward the aft end, trimming the ship using ballast to the extent possible should be immediately considered. This can reduce draft in the engine room and thereby also reduce ingress. RRDA will pay particular attention to hull stress in this case.

3.3.2 Post-Collision Assessment and Considerations

i. Was this a T-bone or side-swiping contact?
ii. What is the other vessel name and IMO number? (RRDA will do a quick search of the Web to source a photograph of the ship)
iii. Other vessel draft at the bow. This information is useful when considering the extent and location of the damage. For example, damage sustained from contacting a cruise ship with an enormous bulbous bow and extensive bow flare is expected to be different to that of a more standard shaped bulk carrier.
iv. Did your ship take a list? How much? Why? Is the ship still settling?
v. Is oil being lost from the cargo tank? At about what rate? Take ullages.
vi. Is the damaged ballast tank taking water or not? If so, take soundings. If the tank is dry, damage may be isolated to above the waterline. It is critical that damage above the waterline remains isolated to above the waterline. If, for whatever reason, the ship is listing to the damaged side, the condition should be checked and options weighed.
vii. If cargo is being lost from the cargo tank but isn't going overboard, it is probably being captured by the ballast tank. If so, as the cargo moves into the ballast tank, asymmetric loading is occurring, particularly as cargo rises

out of the bottom into the side (as in a J-Tank). This will increase the list and may begin to submerge the hull opening and that will cause flooding of the ballast tank and initiate moving oil cargo to the sea as the cargo is displaced by seawater and flows out.

viii. Is there an obvious pollution event originating from your ship? If yes, the ballast tank is probably already full of seawater with cargo oil on the surface.

ix. Is there an unexpected water/cargo interface inside the cargo tank that was not there previously?

x. In the event that the hull opening is known to extend beyond the waterline, consider inducing a list that raises the hull breach out of the water completely. This will prevent any continued loss due to seawater displacing the cargo. This is a decision to be made with careful calculation and should be considered early in order to allow RRDA to analyze the condition and support the decision process. (See note below)

xi. When the extent of the hull opening is known to be below the waterline, consider inducing an increased list to the same side as the damage so that the hull/cargo tank breach is forced further below the surface. This will effectively trap an increased amount of oil in the tank above the damage. Again, this is a decision to be carefully calculated and should be considered early to allow RRDA to analyze the condition and support the decision process. (See note below)

xii. In the event of heavy contact with the bow of another vessel causing significant structural damage to the deck stringer plate and shear strake, a breach in the cargo tank boundary causing cargo loss into the ballast tank and possibly also to the sea is likely. In this case, immediate consideration should be made to reducing the cargo level until it is below the damage. Reduction of cargo level can be done in either or both of the following ways: (See note below)

- List the ship to increase freeboard on the damaged side. This will increase the cargo tank ullage adjacent to the damaged tank boundary.
- Transfer cargo from the damaged tank to available space, preferably on the opposite side of the ship.

Note: Though valid for all tankers, these actions mostly apply when the ship has a large beam. This is because of the relatively large amount of freeboard change that occurs per degree of list, when compared to smaller vessels.

The best action to take under collision related circumstances may not be clear because of difficulties assessing damage. Success will depend largely on how well the tank boundary damage location is measured relative to the waterline.

3.3.3 Notes relating to oil outflow

a. Oil outflow from damaged tanks depends on the induced movement of oil out of the tank, whether because the fill height of the tank creates a head pressure compared to sea level or (and) oil is displaced out of the tank by ingress of seawater with a higher specific gravity than the oil.

b. Double hull technology is known to reduce the likelihood of pollution from ships involved in collision or after a grounding. The structural arrangement requires the ship's structure to be subjected to a higher level of impact energy before the cargo tank boundary fails. The cargo tank boundary will fail if it is subject to sufficiently high local loads. Cargo tank boundary failure may be limited to plate tears in adjacent welds and structure, resulting in oil slowly transferring into the adjacent ballast tank. Alternatively, energy absorbed by a very high inertia event may well cause a large breach in the tank boundary, potentially allowing for very rapid loss of tank content directly into the sea with no opportunity for the ship's crew to influence change.
c. When considering internal transfer of cargo, rapid seawater ingress into the cargo tank will cover the normal tank suction arrangements, preventing suction on the oil. Therefore, pumping must be commenced without delay if oil is to be successfully transferred out of a damaged tank. The effectiveness of the transfer will depend on water ingress rate versus pumping capacity. Always verify that the pump has suction on oil, never proceed on the assumption that suction is effective.
d. If cargo loss rate is slow, with a reasonable amount of time available, use this opportunity to weigh options and implement changes to reduce the final quantity of cargo lost to the sea. RRDA's ability to develop a robust recommendation depends on what you do and do not know.

3.4 Grounding

FOR INFORMATION NEEDED BY RRDA, GO TO Section 4.

Ships are structurally robust and often capable of fully recovering from the effects of grounding. The RRDA team's first goal in a grounding situation is to accurately determine the ground reaction. This lends to determining the extent to which lightering arrangements must be planned or if the ship can be refloated without lightering. Reported flooding and the effect of the tide will be considered, as well as whether there is capacity to internally redistribute load by transferring cargo or fuel or by changing ballast. Level of stress in the hull will be considered based on bottom contact details provided to RRDA or/and as provided in the diver's report.

Groundings range from soft/low impact bottom contact with no damage to fully stranded with total loss. The severity of the grounding event depends on:

- the velocity and inertia of the ship as it takes the bottom,
- hull shape,
- how much vertical reaction is developed as the ship takes the ground,
- sea bottom characteristics,
- buoyancy loss due to breaches in the hull,
- tidal details, and
- subsequent exposure to the environment.

For obvious reasons, an exposed and isolated rocky shoreline in higher latitudes during the winter with contact made at High Water spring tides introduces much higher risk to the vessel than a low impact grounding onto a muddy bottom in a river environment. Fortunately, most groundings tend to occur in the restricted maneuvering environment of port approach channels and fairways, which limits exposure and provides improved access to tugs and other resources.

3.4.1 Comments and Considerations after Grounding

a. **Self-propulsion**
(Upper seawater cooling intakes should be used where possible)
In the stress and urgency of a grounding situation, there is often optimism that the ship can be moved using its own propulsion. However, the thrust generated by the propeller, especially when running astern, is usually relatively small compared to ground reactions likely to develop, resulting in self-propulsion having little or no effect. There are exceptions. For example:

- If the ship is grounded on a hard, isolated pinnacle and has deeper water about the stern, immediate trimming of the ship by the stern, if available, may well allow the vessel to come off.
- Another example is a low reaction event with no loss of buoyancy and with the advantage of a favorable tide. Even so, influences of wind, current and propeller-induced side forces will increase the likelihood of subsequent grounding, including damage to the stern, unless adequate heading and position control can be achieved immediately after refloat.

A proper measure of tug capacity is highly recommended any time a vessel is refloated.

b. **Anchors**
Deployment of anchors should be considered in order to arrest movement onto the lee shore or obstruction. Clearing anchors from the hawse in a controlled condition is preferred, subsequently either walking the chain or letting go, depending on the water depth close-in and whether the seafloor is rising gently or shelving rapidly.

c. **Drafts**
Your initial report to RRDA should include a best estimate of the drafts aground *and the time that the drafts were taken*. RRDA's analysis result is contingent on the accuracy of drafts and the change that occurred as a result of the ship grounding. We fully acknowledge that drafts may be difficult to obtain and confidence in the accuracy of draft readings may be low due to wave action on the hull. Even so, this data is critical. Best efforts are needed to establish a baseline, as fine-tuning for improvement can always be done as the situation settles, as daylight comes, and as support arrives.

i. An attending boat or tug is probably the best way to acquire good drafts and soundings about the hull.
ii. If boats are not available, depending on conditions and equipment on board, the drafts may best be determined by observing the height, or freeboard, from the waterline to the deck or other feature, such as a gunwale top. In this case, the location of each reading must be carefully notated, preferably by frame number, but other notable feature or structure on the deck is also acceptable. This will ensure that the RRDA

team can find the hull depth dimensions at these locations on their model, the general arrangement, or other plans.

d. **Ground description**
An accurate ground description must be provided when possible. RRDA can apply the shape of the contact area to their model when this information is provided. This allows for a more detailed assessment of how the ship will react to changes in loads. It is also important in determining a more complete assessment for hull stresses that may be greatly influenced by bottom support and is essential for planning and monitoring purposes.

- Divers may be used for reporting the contact area. Divers are essential for determining the location of single or multi pinnacle contact areas.
- Contact area(s) can also be reported by soundings taken around the ship using a lead line or other device. Use the form provided in this manual for reporting values. Sketches are greatly encouraged.
    - Soundings taken from the deck edge or other structure will be fine, provided the list (in degrees) is also noted and can be accounted for by RRDA.
- Use an attending pilot boat, tug or FRC to obtain soundings around the ship.
- Be aware that softer bottom materials like mud and clay tend to mound and rise against the bow and will create seemingly odd or questionable depth readings. Trust your readings and report them as measured.
- Be aware that strong currents may cause scouring and deposit, moving sand around the hull, which will cause variations in the sounding.

e. **Damage**
Structural bottom damage frequently occurs during grounding. This can be local buckling causing hull plate cracks and tearing, having little effect on longitudinal strength. Alternatively, it can be gross deformation over large areas of the bottom with impact to the inner bottom structure and internal bulkheads. Identifying the extent of damage under these circumstances will undoubtedly be hindered due to limited or zero access. Voids and tank spaces may be flooded and inaccessible and other internals may be covered with cargo. Tank and void space soundings will indicate where the hull is breached but will not indicate the amount of longitudinal strength lost.

f. **Divers**
Diver support, though very useful, also has significant access limitations under circumstances of flooded void and tank spaces, or cargo covering internals. Only the damage observed and visible can be included in reports. Diver support may be limited due to poor underwater visibility, high currents around the ship, and in some cases the hull can be moving, making work in proximity of the hull especially dangerous.

g. **What if?**
Potential deterioration of onboard conditions must be considered, specifically with respect to the integrity of ship systems that are initially intact and operational but could fail later. For example, piping systems. It may be that

cargo oil could have been transferred away from the damaged area immediately following grounding, but subsequent buckling loads on the lower structure disables piping, ceasing any opportunity for transfer or lightering. In which case, special effort by salvors may be required to remove cargo oil, introducing the potential to become a pollution event.

h. **Engine failure and a Lee Shore**
The case of a ship losing propulsion whilst being set down onto a lee shore can be dire, particularly when a high sea state and rocky shoreline complicate the situation. Under such circumstances, the Master will likely attempt to arrest the ship using anchors.

When weighing options, ballasting may be considered to increase draft so the ship takes the ground in deeper water and further from the shore than it would otherwise. This, of course, is contingent on loading and ballast capacity and varies with vessel design and load plan. Ideally, the resulting condition would allow the ship to be refloated with suitable tug support in attendance after deballasting.

i. **Tank damage and cargo loss to the sea**
If pinnacle loads or extreme ground reaction over an increased area of the bottom structure causes a heavy set-in, the cargo tank boundary around that area could be significantly damaged, and no longer allow cargo to flow into the ballast tank under the influence of head pressure in the cargo tank. This is a complex situation with the results depending on many variables.

In the case of cargo loss, the big question is: will the ship lose cargo to the sea?

Ideally, no seawater has passed into the cargo tank so oil cargo to be pumped from the cargo tank using cargo pumps, either to available volume elsewhere on the ship or by STS transfer. This will allow seawater to flow into the ship, increasing the water cushion and avoiding pollution.

However, a worst-case scenario would be a full cargo tank and the ballast tank has flooded to hydrostatic balance. In this case, a net positive pressure in the tank causes cargo to flow into the ballast tank and then move within the upper structure of the ballast tank, eventually flowing into the side volume between the cargo tank and ship side. As this occurs, sea water will be displaced by the cargo and flow out to the sea through the openings in the bottom plate, assuming these openings are not plugged by mud or clay. This exchange of ballast water for cargo inside the ballast tank will continue until hydrostatic balance occurs among the sea, the ballast tank, and the cargo tank. If balance occurs before the water/oil interface contacts bottom hull plate openings, no pollution will occur at that time. If, however, there is still a net positive head pressure in the cargo tank at the time hydrostatic balance occurs, oil will begin passing out of the hull openings to the sea.

> IMPORTANT SIDE NOTE: With cargo in the ballast tank and no pollution, it is highly important to consider tide. Hydrostatic balance between the sea

and ballast and cargo tanks will cause flow into and out of the breached tank as sea level against the ship changes. What was initially an adequate water cushion inside the ballast tank at high water, can steadily diminish and disappear altogether with low tide, thereby allowing oil into the sea. RRDA can analyze this condition and estimate the potential for oil outflow.

j. **Ballasting down**
If lightering is required to refloat, ballasting the ship may be recommended to ensure it remains hard aground. This allows for the lightering to be completed with no chance that the ship will unexpectedly move and create an unsafe condition. In this case, after the lightering is completed and all associated equipment and personnel are cleared, the ship can be deballasted and refloated at the agreed most suitable time.

k. **Stability**
Like dry-docking, ground reaction causes a virtual rise of the center of gravity, which reduces stability and influences heel, perhaps significantly when stranded on a pinnacle with falling tide. Increase of the bottom's lateral contact area mitigates vulnerability to excessive heel and possible deck edge immersion as the ship becomes supported by the sea floor thereby preventing further heel.

l. **Refloating**
Before the ship is allowed to refloat, particularly when flooding and structural damage are identified, RRDA will analyze the refloat condition to ensure the vessel has sufficient stability and strength margin.

m. **Loss of buoyancy**
When significant buoyancy is lost due to hull breaches with flooding in several spaces, salvors may deem it necessary to induce buoyancy using low pressure compressed air inside the damaged spaces. This forces sea water back out of the hull, reduces ground reaction and improves the afloat condition. With the ship afloat, temporary patches can be applied and the vessel dewatered to the extent needed to meet the requirements of the recovery plan.

n. **Unaccountable list after refloating**
Based on the reported loads, RRDA will determine the drafts, list and trim prior to the refloat, with results. If the ship refloats with a "mystery list," but there is good confidence regarding weight distribution (loads) on board and extent of flooding, the possibility that damaged spaces may have taken on heavy sea floor material should be considered. The extent to which such unintended loading affect list and trim depends on the heeling moment and the ship's initial stability.

3.5 Lightering

Lightering of the vessel may be required for refloating following a grounding event, or to mitigate risks associated with hull stresses, stability, or pollution. The vessel or salvor will develop the plan for lightering, while RRDA may provide supporting analyses that consider the effects of damage and the vessel's condition to assist in the plan development.

3.6 Moving a Damaged Ship

Authorization for moving a damaged ship to be moved is contingent on reviews by flag, the classification society, Coastal State and Port Authority. Other stakeholders also contribute to the process of recovery. Decisions will consider the original voyage plan and whether that plan must be revised to mitigate the risks associated with the vessel's condition. Many of these considerations remain outside of RRDA's scope; however, when a ship sustains damage that affects hull strength and stability, RRDA will continue to provide analyses that determines the margin of strength and stability for the proposed transit route. This work relies on reviewing accurate damage assessment reports that are usually provided by the attending class surveyor.

3.7 Drifting and oil spill

FOR INFORMATION NEEDED BY RRDA, GO TO Section 4.

Working closely with the client, the RRDA team will assist in providing predictive areas and timeframes of potential risks of drifts and oil spill monitoring. There are two steps taken for predicting the oil spill transport and fate:

1. First, RRDA analyzes the incident and estimates the total volume and the time duration of the oil spill using the HECSALV™ tool and or with client input.
2. Second, RRDA predicts the oil spill transport and fate over a number of days following the initial release of oil using NOAA's WebGNOME.

SECTION

4

Useful Forms

The following forms and illustrations are intended to be used for efficiently communicating important information to RRDA. The expectation is that these can be quickly completed by hand and copied to a PDF file for emailing to RRDA@eagle.org.

For editable versions of these forms, contact RRDA@eagle.org

Initial Incident Report

Vessel Name			
IMO Number			
Type of Ship			
Incident Type			
Voyage No.			
Last Departure Port		Dep. Date	
Destination			
Average Daily Fuel Burn			
Current Position			
Managing Company			
Preferred Contact Name			
Preferred Telephone			
Preferred Email			
CC. Email(s)?			

Last Departure Condition has been sent to RRDA@eagle.org? (Most important)	YES	NO	
Correction for bunkers and consumables has been made?	YES	NO	N/A
Departure Conditions are sent routinely on this ship and RRDA has the condition?	YES	NO	N/A
Detailed stowage information has been sent to RRDA@eagle.org?	YES	NO	N/A

ENTER COMMENTS RELATING TO THE ABOVE OR OTHER USEFUL INFORMATION HERE:

Follow-up Incident Report

Ref. Date and Time	(Local/GMT)	
Vessel Name		
Position	Latitude	Longitude
Nature of Incident		
Contributing Information	Hull spaces are breached	Y N (write note below)
	Pollution to the sea	Y N (write note below)
	Hull structure is known to be damaged	Y N (write note below)
	Has cargo moved internally or been lost	Y N (write note below)
	Density of water body	kg/m3
	Ballast system is operational	Y - @ about m3/hr. N
	Cargo pumps operational	Y - @ about m3/hr. N
	E.R. bilge system is operational	Y - @ about m3/hr. N
	Propulsion is available	Y N
	Steering is available	Y N
	Anchors are available	Y N
	Swell height (m) and period (sec)	
	Wind speed (knots) and direction	
	Photos of damage or associated subject	Y N

Vessel is Afloat	Under keel clearance	(m or ft)
	Heel/list (°)	P or S
	Max. roll angle (°) and period (sec)	
	Approx. steady heading	
	Seas breaking on deck	Y N
	Main deck openings secure	Y N (write note below)
	Deck edge immersed	Y N
	Other vessel I.D. (if collision) Name and ship type	

Vessel is Aground	Time of grounding (very important)	(Local/GMT)
	Accurate drafts (very important)	Notate to vessel sketch below
	Time drafts taken (very important)	Notate to vessel sketch below
	Tides: times and range	If requested by RRDA
	Heel	Y N (Add note below)
	Heading	
	Where is the hull aground	Notate to vessel sketch below
	Soundings about the ship	Notate to vessel sketch below
	Nature of the seabed	
	Diver's underwater survey of contact area and damage report	Y N (write note below)
ENTER COMMENTS RELATING TO THE ABOVE OR OTHER USEFUL INFORMATION HERE:		

Oil Spill	Position	Latitude	Longitude
	Start	Date	Time
	Amount		
	Duration		
	Oil Type		
	Location		

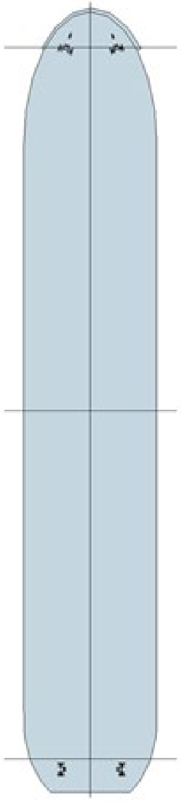
ENTER COMMENTS RELATING TO THE ABOVE OR OTHER USEFUL INFORMATION HERE:

Additional Details About a Grounding Incident

Vessel Name:			
Date:			
1. Drafts - Aground			
Units	Meters	Feet	
Time	-hrs.	Local	UTC
--	Forward	Amidships	Aft
Port			
Starboard			
List of Heel		Degrees	P S
2. Approximate Area of Ground Contact			
Outline the approx. contact area on the hull outline.			
3. Provide water depths (W.D.)			
Water depth values to the extent needed.			
Measured by a boat or tug?			
Measured from ship's deck?			
4. Vessel Heading			
(T) -Degrees			

W.D.	
FR#	

W.D.				**W.D.**
FR#				**FR#**
W.D.				**W.D.**
FR#				**FR#**
W.D.				**W.D.**
FR#				**FR#**
W.D.				**W.D.**
FR#				**FR#**
W.D.				**W.D.**
FR#				**FR#**



W.D.	
FR#	

Handy Sketch for Any Incident

VESSEL NAME: **DATE and TIME:** **UTC/LOCAL**

USE THIS DIAGRAM TO ILLUSTRATE ANY ADDITIONAL PERTINENT INFORMATION LIKE GROUND CONTACT AREA, PINNICLES, AREA DAMAGED, BUCKLING or CRACKS, HULL BREACH, WATER DEPTHS, FREEBOARDS, DRAFTS, OBSTRUCTIONS, ETC.