Rule 7 - Risk of collision

a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt such risk shall be deemed to exist.

b) Proper use shall be made of radar equipment if fitted and operational, including long-range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects.

c) Assumptions shall not be made on the basis of scanty information, especially scanty radar information.

d) In determining if risk of collision exists the following considerations shall be among those taken into account:

   I. such risk shall be deemed to exist if the compass bearing of an approaching vessel does not appreciably change;

   II. such risk may sometimes exist even when an appreciable bearing change is evident, particularly when approaching a very large vessel or a tow or when approaching a vessel at close range.
Rule 7 - Risk of collision

Key words

a) Every vessel
   - All available means
   - Prevailing circumstances
   - Risk of collision

b) Proper use of radar equipment
   - long-range scanning
   - radar plotting
   - systematic observation of detected objects

c) Scanty information
   - Scanty radar information

d) Risk of collision
   - compass bearing does not appreciably change
   - approaching a large vessel, a tow or a vessel at close range
Rule 7 - Risk of collision

- All available means

Simply with one’s eyes

Eye vision
Rule 7 - Risk of collision

All available means  (Rule 7, § (a))

Binoculars
Rule 7 - Risk of collision

All available means

(Rule 7, § (a))

Sunglasses
Polarized or not?

Light reflected from surfaces such as a flat road or smooth water is generally horizontally polarized. This means that, instead of light being scattered in all directions in more usual ways, reflected light generally travels in a more horizontally oriented direction. This creates an annoying and sometimes dangerous intensity of light that we experience as glare. Polarized lenses contain a special filter that blocks this type of intense reflected light, reducing glare.
Rule 7 - Risk of collision

- All available means

Radar(s) + ARPA (+ AIS)
Although there are no provisions made about the AIS in the Colregs, this instrument is a valuable aid to navigation that is very helpful in avoiding risk of collision. However, the AIS does not relieve the OOW to comply with the Rules. Decisions should therefore be primarily based on visual and/or radar information.
Rule 7 - Risk of collision

- All available means (Rule 7, § (a))

AIS

AIS provides following data:

- Ship identification
- Ship type
- Ship position
- Course and speed
- Detection of change of course and speed

For implementation and use, see Rule 5
Rule 7 - Risk of collision

- All available means

(Rule 7, § (a))
Rule 7 - Risk of collision

■ All available means  
(Rule 7, § (a))

VHF

The Marine and Coastguard Agency (MCA) published a Marine Guidance Note (MGN 167) regarding the Dangers in the Use of VHF Radio in Collision Avoidance
Rule 7 - Risk of collision

All available means  (Rule 7, § (a))

The use of VHF Radio in Collision Avoidance may be justified:

− As long as an agreed avoiding action is in compliance with the Colregs
− No misunderstandings can arise in the language communication
− No uncertainties can arise over the identification of vessels and the interpretation of messages received
− If it is not a source of distraction
− If no valuable time is wasted

If above points are not satisfied, the use of VHF may prove to be dangerous

*Although the practice of using VHF radio as a collision avoidance aid may be resorted to on occasion, it is highly recommended in pilotage waters*
Rule 7 - Risk of collision

- All available means
  - Compass bearings or
  - Relative bearings
  - Foreground bearings or
  - Background bearings
  - Radar bearings
  - Plotting detected targets

(Rule 7, § (a))
Rule 7 - Risk of collision

- All available means

(Rule 7, § (a))

Compass bearings or Relative bearings

Compass or relative bearings are called visual bearings and are the more accurate.
Rule 7 - Risk of collision

- All available means  (Rule 7, § (a))

Foreground bearings or Background bearings

A foreground or background bearing is taken without a compass. Taking the foreground bearing of an approaching vessel is done by aligning it with a structure on the observer's own vessel (for instance, the bulwark, a stay, a windsail etc.).

Taking the background bearing of an approaching vessel is done by aligning it with a distant point (for instance, a lighthouse or a landmark).

Foreground and background bearings give only a rough indication re risk of collision.
Rule 7 - Risk of collision

- All available means

(Rule 7, § (a))

Radar bearings

Radar bearings are taken by putting the (illuminated) radar cursor called EBL (Electronic Bearing Line) over the target.

For radar plotting, see further paragraph (b).
Rule 7 - Risk of collision

Prevailing circumstances

- State of visibility
- Traffic
- Navigational hazards

For details, see also Rule 6
It is difficult to define "risk of collision", but, the view of A.N. Cockcroft is, that "risk may be considered to begin when two vessels have approached so close to one another that a departure from the rules by either would bring danger of collision"
Rule 7 - Risk of collision

Risk of Collision (Rule 7, § (a))

Factors determining Risk of Collision:

- The bearing of the vessel(s)
- Distance between two vessels
- Speed of approach
- Do courses cross one another
- The number of vessels in the vicinity

If there is any doubt such risk shall be deemed to exist
Some of the main difficulties in the Colregs are:

- How far apart must vessels be before there is "risk of collision"
- When is a stand-on vessel obliged to "keep course and speed"
Risk of Collision (Rule 7, § (a))

Risk of collision does not apply to vessels at great distances and with a low speed of approach.

Example

At a distance of 14,76 miles, there is no risk of collision; hence, the Colregs do not yet apply.
Rule 7 - Risk of collision

Risk of Collision (Rule 7, § (a))

In rivers, narrow channels, canals and harbours, risk of collision applies at relative shorter distances.

Example

At a distance of 6 miles or less and with a high speed of approach, risk of collision may start to develop; hence, the Colregs do apply.
Remark

With respect to the two previous slides it may be somehow confusing for the student and the young OOW to say: “the Colregs do not yet apply“ or “the Colregs do apply“. These expressions are commonly used by most lecturers and authors and the more experienced OOW fully understands what they mean.

Personally I would prefer to say that “action is not yet necessary“ or “action is necessary or imminent“.

In fact, the minute a vessel leaves the quay the Colregs do apply. Even in the open sea, where nothing is in view, the Colregs apply. Look-out has to be maintained, navigation lights have to be switched on or off, radar has to be observed, sound signals may have to be given, etc.

As soon as a vessel is spotted, the OOW must not necessarily take immediate action but he must be vigilant or extra vigilant and continuously check how the situation develops.
Rule 7 - Risk of collision

Never take a chance

Passing so close behind another vessel is not a safe distance, hence not a good collision avoiding action.

See also comment on Rule 8 “Action to avoid collision
Rule 7 - Risk of collision

- Before proceeding to sea
  - Planning of intended voyage
    - Nautical charts
    - Nautical publications
    - Organization’s guidelines and recommendations
  - Identify a route taking account of:
    - Ships’ routeing systems
    - Ensures sufficient sea room
    - Known navigational hazards
    - Adverse weather conditions
    - Marine environmental protection
Rule 7 - Risk of collision

Proper use of Radar Equipment

(Rule 7, § (b))

The radar allows the OOW:

- To determine if risk of collision with an approaching vessel exists as soon as possible

- To keep a general look-out (see also Rule 5)
Rule 7 - Risk of collision

Proper use of Radar Equipment (Rule 7, § (b))

The use of radar allows the OOW to determine:

- The bearing of a vessel
- The distance of a vessel
- The CPA of a vessel
- The development of a close-quarters situation
- If a give-way vessel is taking appropriate avoiding action
- If a give-way vessel is so close that she cannot avoid a collision on her own
Rule 7 - Risk of collision

Proper use of Radar Equipment (Rule 7, § (b))

Close quarters situation:

- Hatched zone in figure
- 3 or 2 miles depending on:

  - Area (open sea, narrow channel)
  - Size and speed of vessel
  - Manoeuvrability of vessel
  - Hazards in the vicinity
  - Experience
  - Judgement
Rule 7 - Risk of collision

Proper use of Radar Equipment (Rule 7, § (b))

- Appropriate choice of range scale (see long-range scanning)
- Proper setting of the radar
- Choice of appropriate display
- Systematic plotting of echoes

Important elements to be considered are:

- 3, 6, or 12 miles range
- 3 cm or 10 cm radar
- Centered or off-center
- Stabilized or unstabilized
Rule 7 - Risk of collision

Proper use of Radar Equipment (Rule 7, § (b))

Proper setting of radar:
- Gain
- Electronic bearing line (EBL)
- Variable range marker (VRM)
- Heading marker
- Anti-clutter
- Fixed range rings
- Variable range marker
- Etc.
Rule 7 - Risk of collision

Proper use of Radar Equipment (Rule 7, § (b))

Choice of display

- Relative motion
  - Unstabilized ship’s head up
  - Stabilized north up

- True motion
  - Ship’s head up
  - North up
  - Relative trails or true trails
  - Analogue or digital anti-clutter
  - Automatic anti-clutter or automatic adjusting

(See also Rule 6)
Rule 7 - Risk of collision

Proper use of Radar Equipment (Rule 7, § (b))

Main difference between relative motion and true motion

Relative motion
All tracked objects display motion vectors including stationary objects (e.g. buoys)
Own ship is stationary on the screen

True motion
Own vessel and other vessels display their own true motion vectors.
Stationary objects, like buoys show no motion vector

For full details, see a good manual on radar and/or radar watchkeeping

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Rule 7 - Risk of collision

Proper use of Radar Equipment

(Rule 7, § (b))

Relative vectors versus true vectors

Imagine several targets on the radar screen.

How will these targets behave on a relative motion radar and on a true motion radar?

What are the advantages of both systems?
Rule 7 - Risk of collision

Proper use of Radar Equipment
(Rule 7, § (b))

Relative vectors

They show the movement of the targets with regard to the own ship.

The CPA can be determined immediately by tracing a perpendicular from the own ship (in the middle of the screen) to the targets vector.
Rule 7 - Risk of collision

Proper use of Radar Equipment (Rule 7, § (b))

True vectors

True vectors show the movement of the targets with regard to the earth (the ground or the water)

They immediately show the aspect of the ship
Rule 7 - Risk of collision

Proper use of Radar Equipment

(Rule 7, § (b))

Range Rings
The range rings allow a quick measurement of the range of a target

Variable Range Marker (VRM)
The variable range marker allows a precise measurement of the range of a target

Electronic Bearing Line (EBL)
The electronic bearing line allows bearings to be taken with precision

The EBL is an excellent basic tool for collision avoidance
When a suspected target is spotted on the ppi (radar screen), place the EBL on that target.
Rule 7 - Risk of collision

Proper use of Radar Equipment

(Rule 7, § (b))

If the target (e.g. a vessel) moves forward of the EBL, the target will move in front of you.
Rule 7 - Risk of collision

Proper use of Radar Equipment

If the target (e.g. a vessel) moves aft of the EBL, the target will pass behind you.
Rule 7 - Risk of collision

Proper use of Radar Equipment

(Rule 7, § (b))

If the target (e.g. a vessel) remains on the EBL, the target is on a collision course.
The Trail or Wake

The trail or wake of objects are tracks or pads that objects leave on the radar screen. They look as if they leave an afterglow on the screen.

Two types of trails can be considered:

- Relative trails and
- True trails
The vessel on the starboard side that passes across the own ship seems to approach in an oblique direction. This is due to the fact that her movement is the result of her vector and ours. The buoy which in fact stands still also shows a trail.
Proper use of Radar Equipment

This is the same situation as in the previous slide but now in a true presentation. The buoy has no trail as indeed, her speed is equal to zero.

The length of the trail tells the speed of the target relative to the own vessel.
Rule 7 - Risk of collision

Proper use of Radar Equipment

Other elements to be taken into account are:

- Centered or off-centered
- Stabilized or unstabilized
- Analog anti-clutter or digital anti-clutter
- Automatic sea clutter or manual adjusting
- Etc

For details, please refer to a radar tutorial or a radar manual
Rule 7 - Risk of collision

Proper use of Radar Equipment (Rule 7, § (b))

Long Range Scanning

When detecting a target at a rather long distance (e.g. 10 – 12 miles), it gives the OOW ample time to follow this target’s movements such as:

- The development of a close-quarters situation
- The necessary avoiding actions
Short Range Scanning

When detecting a target at a shorter range (e.g. 3 miles or less), it gives the OOW less time to assume the situation properly or to take the appropriate avoiding action.

Besides, it may give the OOW the false impression, when observing a target close to the edge of the screen that this target is further away than it actually is. Especially in restricted visibility or when ranges are regularly switched between 12 and 3 miles.
Rule 7 - Risk of collision

Proper use of Radar Equipment

(Rule 7, § (b))

Radar Plotting

- Types of radar plotting
  - Relative plotting
  - True plotting
  - Anti-collision plotting
  - Automatic plotting
  - Photo plot
  - Etc.
Basic Relative Plotting

Usually, the display is set to ship’s head up, in relative mode. The own vessel is in the center of the screen.

The plotting can be done on special plotting sheets or on the radar screen with a special greasy pencil.

The bearings are taken with the EBL and the distances with the variable range ring.

Several observations of the same object should be taken.

The figure shows the first observation of the object or target A. Time 10h05, speed 12 mph.
Rule 7 - Risk of collision

- Proper use of Radar Equipment

Basic Relative Plotting

The same target is plotted again. It is marked B. Time 10h10, Speed 12 mph
Rule 7 - Risk of collision

Proper use of Radar Equipment

Basic Relative Plotting

The same target is plotted again and marked C. Time 10h15, speed 12 mph
Rule 7 - Risk of collision

Proper use of Radar Equipment

Basic Relative Plotting

Now, we draw a line through A, B and C and make it pass well over our heading marker.
Proper use of Radar Equipment

Basic Relative Plotting

From A draw a line down the plotting sheet, parallel to the heading marker or course line.
Rule 7 - Risk of collision

- Proper use of Radar Equipment (Rule 7, § (b))

Basic Relative Plotting

From A, on the line going down, measure the distance equal to your distance ran between the first and the last plot thus, between A and C.

The first plot was taken at 10h05 and the last one at 10h15 which amounts to 10 minutes.

Since your speed is 12 mph, your distance ran can be determined by using the “rule of three”.

In 60 minutes you run 12 miles; in 1 minute 60 times less and in 10 minutes 10 times more; hence 2 miles.

\[(12 \times 10) : 60 = 2\]
Rule 7 - Risk of collision

Proper use of Radar Equipment

Basic Relative Plotting

From D draw a line through C

Line DC is the plotted vessel’s (or object’s) course and speed
Rule 7 - Risk of collision

Proper use of Radar Equipment

(Rule 7, § (b))

Basic Relative Plotting

From the centre of the screen (own vessel) draw a perpendicular on line AC. This gives you the CPA (Closest Point of Approach)

REMARK

For a true (or real) representation of above plotting situation see following slides
Rule 7 - Risk of collision

- Proper use of Radar Equipment

Rule 7, § (b)

True Situation

Position A

Position B

Position C
Rule 7 - Risk of collision

Proper use of Radar Equipment

(Rule 7, § (b))

The previous situation can also be depicted in one representation.

Figure 1a and the orange coloured elements in figure 1b are identical. They depict the true situation as described earlier. In this situation, the own ship also moves (the same way as the target ship).

In the relative mode, however the own ship remains in the center of the screen. To obtain the same radar image as described in the previous slides it is, consequently, imperative to transpose the speed and course lines from own ship to B B’ and C C’, the bleu lines and plotted targets in figure 1b.
Rule 7 - Risk of collision

Proper use of Radar Equipment

(Rule 7, § (b))

Conclusion

There are mainly three ways to plot another vessel or an object:

- In relative mode
- In true mode
- with ARPA

The relative mode and true mode give a different layout on the radar screen and may, for the neophyte, look rather confusing, especially in the relative mode. Hence, in this mode it is imperative to exercise frequently in clear visibility to avoid excessive and difficult brainwork in restricted visibility.

It is indeed a fact that in the relative mode, the plotted vessel or object seem to be following a different course than it is actually doing.

The true plotting mode gives a more realistic view on the other vessel’s movements and the ARPA allows you to obtain all valuable information automatically.

Since 01-09-84, all vessels of 10.000 tons (GT) and over must be equipped with an ARPA and since 01-07-08, all new radars must be able to display AIS information.
Rule 7 - Risk of collision

- Scanty Radar Information (Rule 7, § (c))

All observations must be as accurate as possible.

Avoid to draw conclusions on just a few observations of the same target.

At least three or more successive observations should be taken.

Some OOW can be a bit careless when it comes to take measurements of distances and angles.

A small difference in bearings, especially at long distances, can make the difference in determining whether there is risk of collision or not.
Suppose that you are spotting a target at 9.5 miles, bearing Sb 015°.

As we saw earlier on, if the plotted target remains on the EBL both vessels will collide.

But, if you are careless and you read your next bearing as Sb 017° (instead of Sb 015°) at the distance of 7.5 miles, (blue target and blue EBL) you will think that this vessel will pass on your starboard side, clear of you.
Rule 7 - Risk of collision

Scanty Radar Information

Likewise, if you are careless and you read your next bearing as Sb 013° (instead of Sb 015°) at the distance of 7,5 miles, (blue target and blue EBL) you will think that this vessel will pass on your port side, clear of you.

Conclusion

Small errors in bearings can lead to great errors, especially at great distances.
Rule 7 - Risk of collision

Change of bearings (Rule 7, § (d))

- Bearing does not change
  - There is risk of collision
- Bearing decreases
  - No risk of collision; vessel will pass ahead
- Bearing increases
  - No risk of collision; vessel will pass astern
- Bearing changes very little
  - Assume there is risk of collision
Rule 7 - Risk of collision

Change of bearings

(Rule 7, § (d))

The change of bearing of an approaching vessel is the best way to determine if there is a risk of collision.

Rule 7 § (d) (i) refers to compass bearings, but radar bearings will do the job as well, especially in restricted visibility.

However, compass bearings give usually greater accuracy than radar bearings.
Rule 7 - Risk of collision

Change of bearings

(Rule 7, § (d) (i))

If the bearing does not appreciably change and you do not take any avoiding action in time

YOU WILL COLLIDE
Rule 7 - Risk of collision

Change of bearings

(Rule 7, § (d) (ii))

When a change of bearing is evident, risk of collision may still exist when approaching a very large ship.

Bearing errors may exist when own ship is rolling and pitching.
When a change of bearing is evident, risk of collision may still exist when approaching a tow.
When a change of bearing is evident, risk of collision may still exist when approaching a vessel at close range.
Rule 7 - Risk of collision

- In case of doubt (Rule 7, § (a))

- Risk of collision is deemed to exist