31ª Conversazione

Allegato :

La pubblicazione: BRIDGE TEAM MENAGEMENT

A practical guide by Captain A.J. Swift, MNI

All'attenzione dei Colleghi

Repetita Juvant
Accipe librum et devora illum
Vivere est cogitare

1)

PASSAGE PLANNING

The Nautical Institute Council

FOREWORD

PASSAGE PLANNING is a way of minimising the risk of navigational errors. With tighter schedules, reduced manning, faster turn-rounds and more intense operations, the requirement for pre-planning becomes even more necessary.

The aim of passage planning is to prepare for the navigation of a ship so that the intended passage can be executed from berth to berth in a safe manner in respect of both the vessel and protection of the environment, as well as ensuring positive control of the vessel at all times. Without planning, the time to process essential information may not be available at critical times when the navigator is occupied confirming landmarks, altering course, avoiding traffic and carrying out other bridge duties such as communications. Under these circumstances mistakes can be made and errors go undetected.

A particular benefit of planning is that it enables the appropriate navigational methods to be used at different phases of the voyage. In narrow or confined waters it becomes more important to concentrate on forward-looking pilotage techniques. However, before they can be applied it is necessary to provide detailed guidance in advance.

Passage planning can be time consuming and therefore carries a cost in terms of human resources, expertise and supporting administration.

The value of passage planning is difficult to quantify. If it is done well, and the ship's navigation is consistently reliable, then there is no cost penalty against which to assess its relative merits to the company. However, if it is not practised, the costs of navigational incidents can be significant.

Some guidance is provided in the STCW Convention concerning 'Basic Principles to be Observed in Keeping a Navigational Watch' which states that:

> ***'The intended voyage shall be planned in advance taking into consideration all pertinent information and any course laid down should be checked before the voyage commences'.***

However, this statement needs further amplification if it is to be meaningful.

This briefing, therefore, is designed to focus on the principles of passage planning and the plan's execution, and to provide a document which can be discussed both at sea and ashore to encourage a professional commitment.

Captain L.A. Holder, ExC, MPhil, FNI, FRIN, FCIT, President, The Nautical Institute, January 1994.

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PASSAGE PLANNING

Aim

THE AIM of this briefing is to demonstrate to governments, marine management, masters, pilots and deck officers that passage planning from berth to berth is an essential navigational discipline and that it must be supported, encouraged and applied as part of bridge team management.

Scope

This Nautical Institute briefing outlines the principles of berth-to-berth passage planning. It covers the subject within the context of coastal navigation; however, ocean passages must also be planned in detail. It assumes a knowledge of navigation and the use, and limitations, of radar and other aids to navigation.

Planning

The purpose of passage planning is to ensure positive control over the safe navigation of the ship at all times. To achieve this purpose, the ship's track to be made good, once it has been finally put on to the chart, will become the focus of attention.

For ferries, liners and other vessels engaged on regular passages, the passage plan will have been established for normal operating conditions and only the variable items like weather and tidal information will need to be updated. If, however, the vessel changes route or the officers change, then thorough briefings will need to take place.

For the majority of ships visiting different ports, the process of planning must be given due consideration. Early advice about an intended voyage may come from a variety of sources and frequently the master will need to provide a voyage itinerary quickly, covering distances, times and restrictions for provisional cargo bookings. Once the intended voyage has been confirmed, planning will commence in detail. The master should discuss an outline route with the navigation officer. The appraisal process will then take place, during which all relevant information will be collected from sources such as those listed in Table 1, while bearing in mind those parameters listed in Table 2.

This information will then be used in preparing the plan, along with guidance from the master concerning, for example,the clearing distances which he considers appropriate. The navigating officer will ensure that the ship can always be navigated in safe waters, that critical parts of the voyage are identified, voyage timings are checked and that the appropriate navigational techniques required for each part of the voyage are highlighted. It has to be stressed that the plan must be complete, from berth to berth. **The plan must also include those parts of the voyage during which it is expected that a pilot will be on board.**

The construction of a passage plan encourages all those concerned to think ahead, to foresee potential problems and plan a strategy to minimise risk. Contingency plans must be made, such as identifying deep-water escape routes from turns, possible alternative routes and emergency anchorages. The plan must take into account the expected traffic flow and be flexible enough to allow for collision avoidance in line with the International Regulations for Preventing Collisions at Sea.

TABLE 1

Information sources for passage planning include:

1. **Chart catalogue.**
2. **Navigational charts.**
3. **Ocean passages for the world.**
4. **Routeing charts, pilot charts and IMO Ship's Routeing.**
5. **Sailing directions and pilot books.**
6. **Light lists.**
7. **Tide tables.**
8. **Tidal stream atlases.**
9. **Notices to Mariners (Navareas, Hydrolants, Hydropacs).**
10. **Radio signal information (including VTS and pilot service).**
11. **Climatic information, meteorological and oceanographic data. Weather, seastate and ice forecasts.**
12. **Loadline chart.**
13. **Distance tables.**
14. **Electronic navigational systems information.**
15. **Radio and local warnings.**
16. **Owner's and other unpublished sources.**
17. **Manoeuvring data.**
18. **Personal experience.**
19. **Mariner's Handbook.**
20. **Guide to Port Entry.**

TABLE 2.

Vessel's status reports needed for passage planning include:

1. **Main propulsion system.**
2. **Steering gear.**
3. **Navigational equipment.**
4. **Anchors.**
5. **Thrusters.**
6. **Auxiliaries.**
7. **Trim and draught of vessel and air draught.**
8. **Transverse stability.**
9. **The availability of manpower.**

Preparing the plan

When preparing the plan the navigating officer will need to take account of the following

- Adequate underkeel clearance at all times, including allowances for squat, pitch, roll, swell, predicted tidal height and possible increase of draught due to heel and trim.
- Safe distances off dangers, allowing for weather, tidal stream, anticipated traffic, reliability of survey data, availability of safe water and navigational systems in use.
- Alter-course positions which can be monitored conveniently by means of radar or by visual bearings.

- Management of chart changes, which should not occur at critical points of the passage.
- Traffic Separation Schemes, and the requirements of Rule 10.
- Predicted tidal information, leading to the pre-working of allowances for set. Tidal constraints limiting ETD/ETA at locks, etc.
- Visibility of lights, rising/dipping distances, arcs and colours of light sectors.
- Safe speeds along the route, leading to a speed plan, and an ETA plan, making due allowance for possible reduced visibility. A plan for reducing speed under control should be considered.
- Selection of depths for comparison with the echo-sounder, taking note of the predicted height of tide.
- Reporting points, VHF frequencies, VTS requirements, areas of special concern and pilot stations. Points for taking tugs.
- Abort positions and contingency plans in case of accident or emergency or bad visibility.
- The primary and secondary systems of navigation to be used.
- Requirements for any electronic chart systems.
- All charts and publications available are up to date.
- Equipment status.
- Margins of allowable error, safety clearing bearings and ranges.
- The making up of a bridge, or conning, notebook.
- Choice of ocean route (circle, composite or rhumb line).
- Choice of ocean route to avoid weather/ice.

The master must satisfy himself that the passage plan meets all his requirements and he must then ensure that all watchkeeping officers are properly briefed; and that the plan is kept amended and up to date for the intended passage.

Monitoring the passage plan

It is common practice on merchant ships to fix the ship's position and then make an allowance for set and drift depending upon offset from the previous fix. This approach to navigation is REACTIVE, being based upon past observations. If either of these is wrong, then any predictions using them will be erroneous. When using fixes in this way, it is usually better to make the fixes at regular intervals. This enables a simple check to be made with respect to speed. It also helps the quick and effective calculation of short-term EPs (Estimated Positions), using the latest course and speed made good, to warn of any immediate problems developing.

However, in narrow waters, techniques need to be used which enable the navigator to maintain a forward outlook, that is to be PROACTIVE, whilst monitoring the deviation from the intended track being made good. Frequent, hurried visits to the chart table to fix the vessel's position may not be the most effective use of the time available. Also, whilst doing this the overall sense of awareness can be interrupted and it is easy during critical phases to become disorientated. It is worth remembering to monitor the echo-sounder. This instrument can often provide the first warning signs that the vessel is standing into danger, since in almost all situations the nearest land is beneath the vessel.

Passage planning therefore should be a preparation for effective piloting by selecting, and marking in advance, those relevant navigational techniques which will lead to safe control of the ship and adherence to the plan.

This point was emphasised in the *Nautical Briefing on Bridge Watchkeeping,* when the Council of The Nautical Institute observed that:

'The need to confirm the ship's position frequently is a statement which needs further examination. A fix should be taken whenever the vessel completes a turn on a new track and at regular intervals thereafter. The fix interval should be such that the vessel cannot be set appreciably off track or into danger by the anticipated effects of tidal stream, wind or currents in the period between fixes. As the ship approaches confined waters the fix interval becomes shorter. When appropriate navigational markers have been identified, pilotage techniques should be used.'

There can be a reluctance amongst some officers to accept pilotage techniques as valid methods of navigation. This inhibits their use and application, so depriving the bridge team of predictive information when it is most needed.

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2) Allego qui lo svolgimento dei quesiti A, B, C, D, E, F e G proposti nella 25ª Conversazione del 28.11.2012.

Napoli 16.09.2013

Con Affetto
Franco Esposito

Risposta n° 2

Rari nantes in gurgite vasto

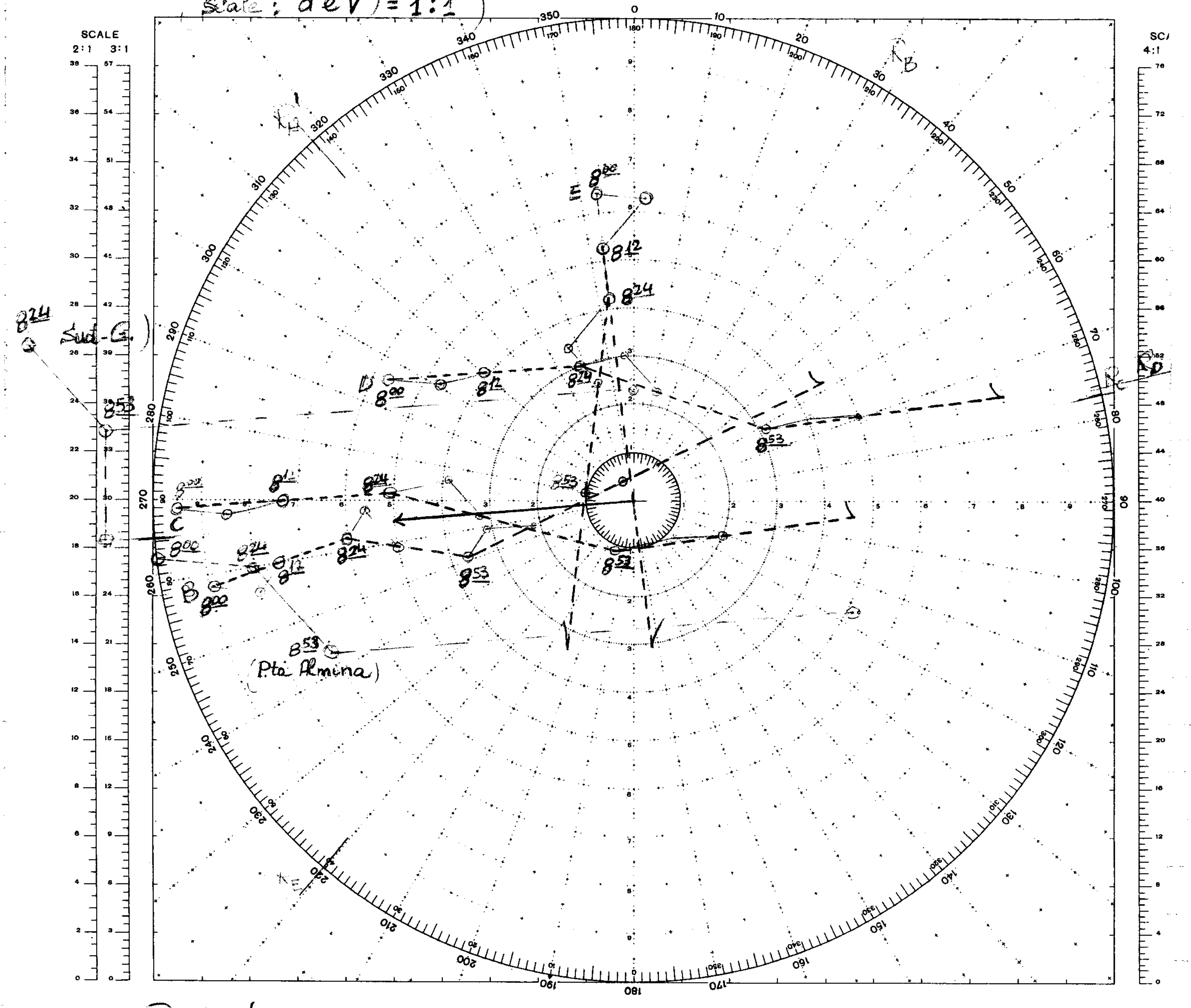
Quesito A

I. I. 2097 bi

ISTITUTO IDROGRAFICO DELLA MARINA

(Rule 19 : Conduct of vessels in restricted visibility)

(Scale : d e V) = 1 : 1)



Risposte:

1) R'A = 318° ; 2) T.C.P.A. = 8h 53m ; 3) R''A = 265,5° ; 4) La nave B passa ad un C.P.A = 0,5 mg ; 5) T = 11h 05m

MIGLIA

YARDS

METRI

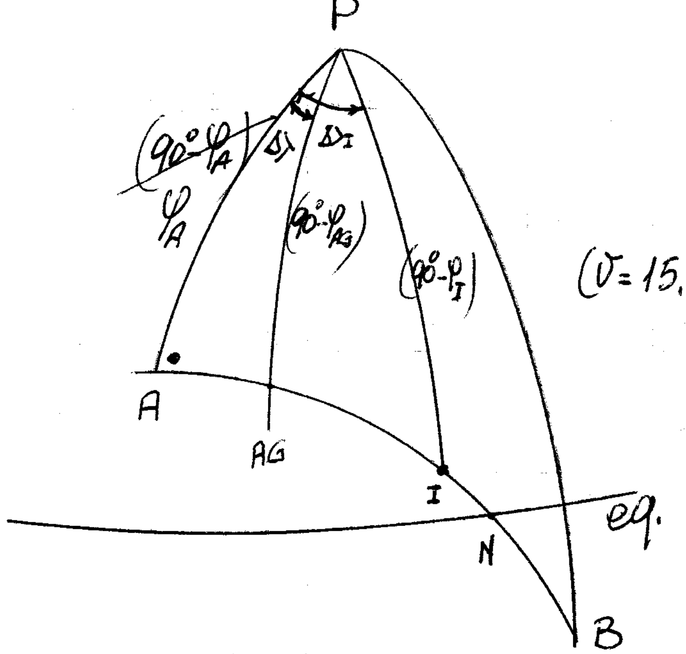
S = V . T

NOTE DUE VARIABILI, LA CONGIUNGENTE DEI PUNTI CORRISPONDENTI AI LORO VALORI LETTI NELLE RISPETTIVE SCALE, DETERMINA, PER INTERSEZIONE CON LA TERZA SCALA, IL VALORE DELLA VARIABILE INCOGNITA.

NOTA

I "triangoli cinematici" (meglio, i triangoli dei percorsi) sono "costruiti" sui bersagli. Perché?

Quesito B



$$t_a = 180°\ 00',0$$
$$-\lambda = -130°\ 13',7$$
$$T_a = 49°\ 46',3$$
$$(v = 15,1)\quad -T'_a = -45°\ 33',4 \qquad T'_m = 11^h\ 00^m\ 00^s \text{ del } 15/05$$
$$I_a = 04°\ 12',9$$
$$-pp = -4,4$$
$$I'_a = 04°\ 8',5$$

$$I_m = 17^m\ 22^s$$
$$T_m = 11^h\ 17^m\ 22^s \text{ del } 15/05$$
$$+f = +9^h$$
$$t_f = 20^h\ 17^m\ 22^s \text{ del } 15/05$$

1) $\cos\Delta\lambda = \cot\varphi_A\ \tan\varphi_{AG}$; $\tan\varphi_{AG} = \cos\Delta\lambda \cdot \tan\varphi_A = 0,176115282$

$$\lambda_{AG} = 180°\ 00',0$$
$$-\lambda_A = -130°\ 13',7$$
$$\Delta\lambda = 49°\ 46',3$$

A.G. $\begin{cases}\varphi_{AG} = 09°59'18''\ N \\ \lambda_{AG} = 180°00'00''\end{cases}$

2) $d_{AN} = 90° = 5400\ mg$; $d_{AI} = d_{AN} - 600 = 5400 - 600 = 4800\ mg = 80°$

$\cos\varphi_A = \cot\Delta\lambda_I\ \tan d_{AI}$; $\tan\Delta\lambda_I = \dfrac{\tan d_{AI}}{\cos\varphi_A} = 5,878364737$

$\cos(90° - \varphi_I) = \operatorname{sen}\varphi_A \cos d_{AI}$

$\operatorname{sen}\varphi_I = \operatorname{sen}\varphi_A \cos d_{AI} =$
$= 0,045684638$

$$\Delta\lambda_I = +80°\ 20',7$$
$$+\lambda_A = +130°\ 13',7$$
$$\lambda_I = +210°\ 34',4$$

$\begin{cases}\lambda_I = 149°\ 25',6\ W \\ \varphi_I = 02°\ 37',1\ N\end{cases}$

3)
$$\lambda_A = 130°\ 13',7$$
$$+\Delta\lambda_{(A\text{-}N)} = +90°$$
$$\lambda_N = 220°\ 13',7\ E$$
$$\lambda_N = 139°\ 46',3\ W$$

$$\Delta t = \frac{5400}{20} = 270^h = 11^d\ 06^h\ 00^m$$

$$T_m = 11^h\ 17^m\ 22^s \text{ del } 15/05$$
$$+\Delta t = 06^h\ 00^m\ 00^s \quad 11^d$$
$$T'_m = 17^h\ 17^m\ 22^s \text{ del } 26/05$$
$$+f = -9^h$$
$$t_f = 08^h\ 17^m\ 22^s \text{ del } 26/05$$

4) $\lambda_B = -078°\,05',4$
$-\lambda_A = -130°\,13',7$
$\Delta\lambda_{AB} = -208°\,19',1$
$\Delta\lambda_{AB} = 151°\,40',9\ E$

$\cos\varphi_A = \cot g\,\Delta\lambda_{(A-B)}\ \tan g\, d_{(A-B)}$

$\tan g\, d_{(AB)} = \cos\varphi_A \cdot tg\,\Delta\lambda_{(AB)} = -0{,}519874484$

$d_{(AB)} = 9151{,}88\ mg$

$\Delta t = \dfrac{9151{,}88}{20} = 457^h\,35^m\,38^s = 19^d\,01^h\,35^m\,38^s$

$Tm = 11^h\,17^m\,22^s$ del 15/05
$+\Delta t = 01^h\,35^m\,38^s$ 19^d
$T'm = 12^h\,53^m\,00^s$ del 03/06/2012
$+tf = -5^h$
$tf = 07^h\,53^m\,00^s$ del 03/06/2012

Quesito C

Correzione $C = +0{,}2\ m.$; $tf_{BM} = 09^h\,45^m$ $h = 1{,}20\ m.$; $tf_{AM} = 16^h\,00^m$ $h = 5{,}40\ m.$

$tf_{AM} = 16^h\,00^m$
$-tf_{BM} = -09^h\,45^m$
$T = 06^h\,15^m$

$tf = 14^h\,40^m$
$-tf_{BM} = -9^h\,45^m$
$\Delta t = 04^h\,55^m$

$D = (h_{AM} - h_{BM}) = (5{,}40 - 1{,}20) = 4{,}20\ m.$

$x = D\, sen^2 \dfrac{90° \cdot \Delta t}{T} = 3{,}75\ m.$

$h = h_{BM} + x = 1{,}20 + 3{,}75 = 4{,}95\ m.$

$\bar{h} = 11{,}44 + 0{,}70 - 7 = 5{,}14\ m$; $\Delta I = (5{,}14 - 4{,}95) = 0{,}19\ m. = 19\ cm.$

1) $P_{(zavorra)} = 19 \times 20 = 380\ ton.$

2) $D = 4{,}20\ m$; $T = 06^h\,15^m$; $x = \bar{h} - h_{BM} = (5{,}14 - 1{,}20) = 3{,}94\ m.$

$\Delta t = 05^h\, 14^m\, 58^s$

$$t_{f_{BM}} = 09^h\, 45^m$$
$$+\Delta t = 05^h\, 14^m\, 58^s$$
$$(\text{istante di attraversamento})\ t_f = 14^h\, 59^m\, 58^s$$

La nave quindi deve percorrere 36 miglia in $2^h\, 19^m\, 58^s$

$$v = \frac{36}{(2^h\, 19^m\, 58^s)} = 15,43 \text{ nodi}$$

Quesito D

(Lo svolgimento si trova alla pagina seguente)

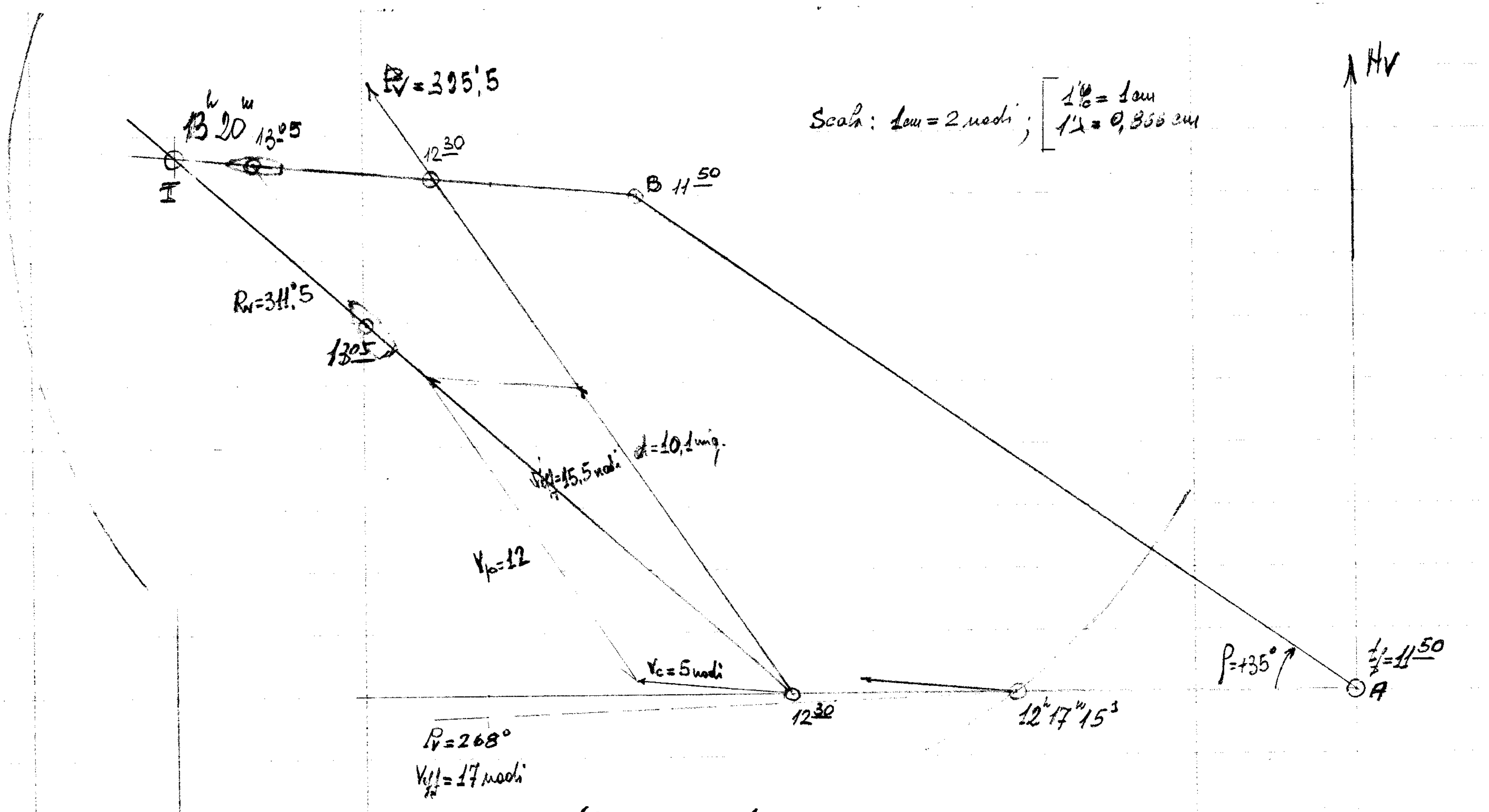
Risposte

- Coordinate del punto di collisione (I):

$$\begin{cases} \varphi = 30°\, 08',6\ N \\ \lambda = 179°\, 36',3\ E \end{cases}$$

- l'istante di collisione: $t_f = 13^h\, 20^m$ del ...

Quesito D



$$I \begin{cases} \varphi = 30°\ 08',6\ N \\ \lambda = 179°\ 36',3\ E \end{cases}$$

Quesito E

Punto di riferimento: P.ta Timone.

Ex-Semaforo di Capo Figari

$\varphi = +40° 59',8$
$-\varphi = -40° 55',6$
$\Delta\varphi = +\ 04',2$
5,04 cm

$\lambda = +09° 39',2$
$-\lambda = -09° 44',0$
$\Delta\lambda = -\ 04',8$
4,344 cm

Faro di Capo Ferro

$\varphi = +41° 09',2$
$-\varphi = -40° 55',6$
$\Delta\varphi = +\ 13',6$
16,32 cm

$\lambda = +09° 31',6$
$-\lambda = -09° 44',0$
$\Delta\lambda = -\ 12',4$
11,222 cm

Scoglio di Mortoriotto

$\varphi = +41° 05',1$
$-\varphi = -40° 55',6$
$\Delta\varphi = +\ 09',5$
11,4 cm

$\lambda = +09° 37',1$
$-\lambda = -09° 44',0$
$\Delta\lambda = -\ 06',9$
6,2445 cm

$\varphi = 40° 55',6$
$+\varphi = 41° 09',2$
$2\varphi_m = 82° 04',8$
$\varphi_m = 41° 02',4$ N

$1'\varphi = 1,2$ cm
$1'\lambda = 0,905$ cm

Risposte:

Le coordinate del P_N alle $11^h 20^m$:

$\varphi_{SM} = 41° 05',1$
$+\Delta\varphi = +\ 02',6$
$\varphi_0 = 41° 07',7$ N

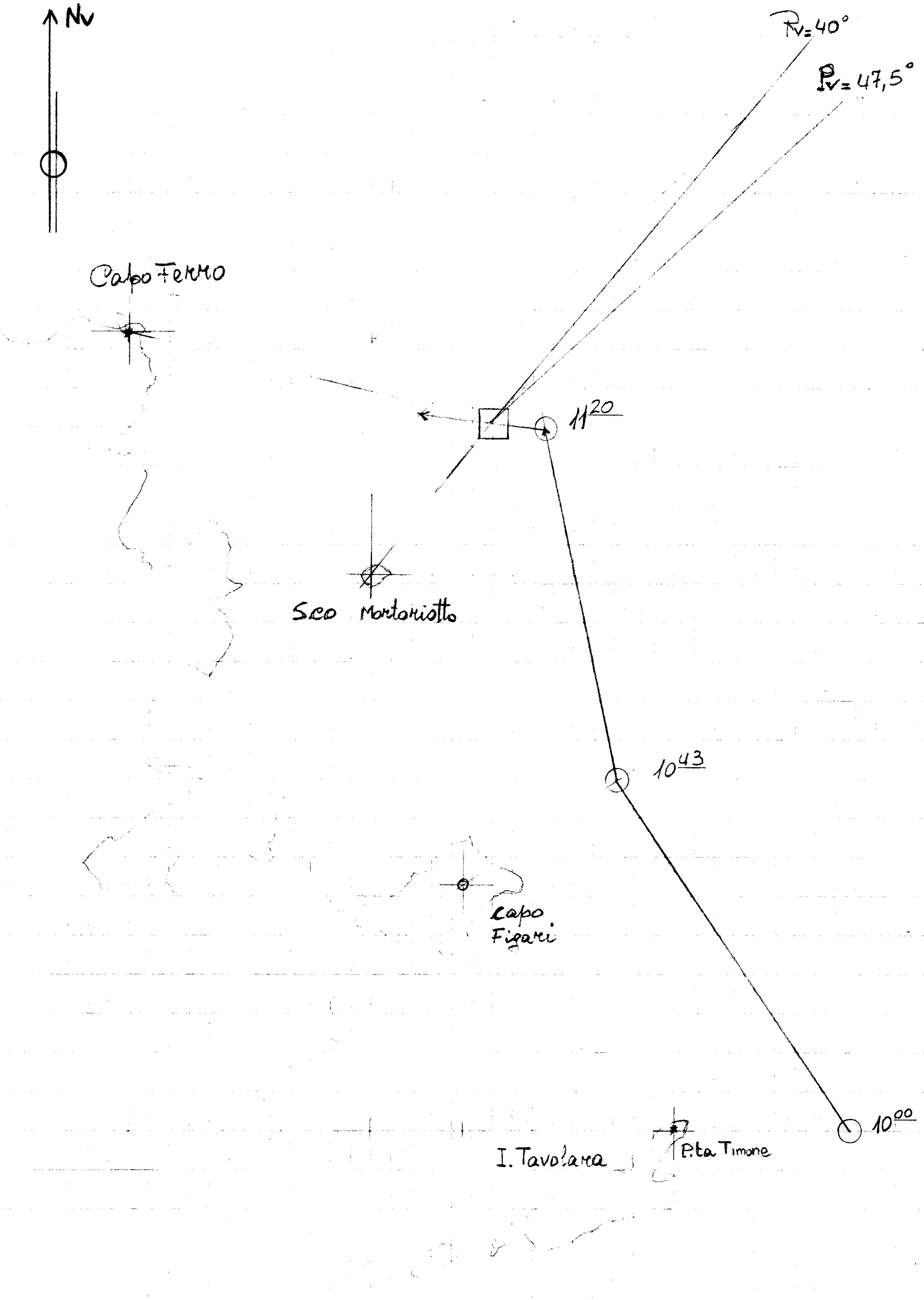
$\lambda_{SM} = +09° 37',1$
$+\Delta\lambda = +\ 02',7$
$\lambda_0 = 09° 39',8$ E

Corrente: $A_c = 278°$ $V_c = 1,47$ nodi.

$V_{eff} = 8,15$ nodi; $P_v = 47,5°$; $tg\,\delta g = -\dfrac{V \cos R_v}{900 \cdot \cos\varphi} = 0,009209514$; $P_v = 47,5°$

$\delta g = -0,5°$

$P_v = 47,5°$
$-\delta g = +\ 0,5°$
$P_g = 48,0°$


Nv
Rv=40°
Pv=47,5°
Capo Ferro
11 20
Sco Mortoriotto
10 43
Capo Figari
10 00
I. Tavolara
P.ta Timone

Quesito E
(Svolgimento Analitico)

$10^{00} \rightarrow$ (punto di partenza) : $\Delta\lambda = \dfrac{3}{\cos(40°55',6)} = 3',97$

$$\begin{array}{r} \lambda = +09°44'00'' \\ +\Delta\lambda = +\quad 03'58'' \\ \hline \lambda = 09°47'58''E \end{array}$$

1 - ($\varphi_1 = 40°55',6\,N$; $\lambda_1 = 09°47'58''E$) $R_1 = 326°$

2 - ($\varphi_2 = 40°59',8\,N$; $\lambda_2 = 09°39',2\,E$) $R_2 = (326° - 270°) = 56°$

$$\begin{array}{r} \lambda_2 = +09°39'12'' \\ -\lambda_1 = -09°47'58'' \\ \hline (\lambda_2 - \lambda_1) = 00°08'46'' \end{array}$$

$$\varphi_{c\,(P_H)} = \frac{(\lambda_2 - \lambda_1) + \varphi_{c1}\,tg R_1 - \varphi_{c2}\,tg R_2}{(tg R_1 - tg R_2)} = 2703,660408$$

$\varphi = 41°01'33''N$

$$\begin{array}{r} \varphi'_c = +2703,66 \\ -\varphi_{c2} = -2701,34 \\ \hline \Delta\varphi_c = +\quad 2',32 \end{array}$$

$\Delta\lambda = \Delta\varphi_c\, tg R_2 = 03'26''$

$$\begin{array}{r} \lambda = +09°39'12'' \\ +\Delta\lambda = +\quad 03'26'' \\ \hline \lambda = 09°42'38''E \end{array}$$

$$\begin{array}{r} \varphi = +41°01'33'' \\ -\varphi_1 = -40°55'36'' \\ \hline \Delta\varphi = +\quad 05'57'' \end{array}$$

$m = \dfrac{\Delta\varphi}{\cos 326°} \cong 7,17\,mg$; $\Delta t = \dfrac{7,17}{10} = 00^h 43^m$

La nave si trova al traverso dell'Ex-semaforo di Capo Figari alle $10^h 43^m$.

Punto stimato alle $11^h 20^m$: $\Delta t = (11^h 20^m - 10^h 43^m) = 37^m$

$m = (10 \cdot 37^m) = 6,1\bar{6}\,mg$; $R_v = 348°$ $r = N\,12°\,W$

$\Delta\varphi = m \cos r = 06'$ $\qquad$ $\Delta\lambda = m\,sen\,r / \cos\varphi_m = 1',7 = 01'42''$

$$\begin{array}{r} \varphi = +41°01'33'' \\ +\Delta\varphi = +\quad 06'00'' \\ \hline \varphi_3 = 41°07'33''N \end{array} \qquad \begin{array}{r} \varphi = +41°01'33'' \\ +\Delta\varphi/2 = +\quad 03' \\ \hline \varphi_m = 41°04'33''N \end{array} \qquad \begin{array}{r} \lambda = +09°42'38'' \\ +\Delta\lambda = -\quad 01'42'' \\ \hline \lambda_3 = 09°40'56''E \end{array}$$

Punto nave alle $11^h 20^m$:

Faro di Capo Ferro - 1 - ($\varphi_1 = 41°09',2$ N ; $\lambda_1 = 09°31',6$ E) $R_1 = 104°$

Scoglio di Mortoriotto - 2 - ($\varphi_2 = 41°05',1$ N ; $\lambda_2 = 09°37',1$ E) $R_2 = 38°$

$$\begin{array}{l} \lambda_2 = +09°37',1 \\ -\lambda_1 = -09°31',6 \\ \hline (\lambda_2-\lambda_1) = +\ 05',5 \end{array} \qquad \varphi_e = \frac{(\lambda_2-\lambda_1)+\varphi_{c1}\,tg R_1 - \varphi_{c2}\,tg R_2}{(tg R_1 - tg R_2)} = 2711{,}769714$$

(P_N)

$(\varphi = 41°07'40''$ N$) \Rightarrow \varphi = 41°07',7$ N

$$\begin{array}{l} \varphi'_e = +2711{,}77 \\ -\varphi_{c2} = -2708{,}36 \\ \hline \Delta\varphi_e = +\ \ 3{,}41 \end{array} \qquad \Delta\lambda = \Delta\varphi_e\, tag R_2 = 2',7 \qquad \begin{array}{l} \lambda_2 = +09°37',1 \\ +\Delta\lambda = +\ \ \ 2',7 \\ \hline \lambda = 09°39',8 \end{array}$$

Rotta e cammino tra P_N e P_S :

$$\begin{array}{l} \varphi_0 = +41°07'40'' \\ -\varphi_1 = -41°07'33'' \\ \hline \Delta\varphi = +\ \ \ \ \ \ 7'' \end{array} \qquad \begin{array}{l} \lambda_0 = +09°39'48'' \\ -\lambda_1 = -09°40'56'' \\ \hline \Delta\lambda = -\ \ \ 01'08'' \end{array} \qquad \begin{array}{l} \varphi_0 = +41°07'33'' \\ +\Delta\varphi/2 = +\ \ \ \ \ \ 3'',5 \\ \hline \varphi_m = +41°07'36'',5 \end{array}$$

$tag\, r = \dfrac{\Delta\lambda \cos\varphi_m}{\Delta\varphi} = 7{,}317341668$; $r = N\, 82°13'05''\, W$; $R = 277{,}78$

$Ae = 278°$

$m = \Delta\varphi / \cos r = 0{,}8616$ mg ; $V_c = \dfrac{0{,}8616}{(37^m)} = 1{,}397$; $Ve = 1{,}4$ nodi

Calcolo della Pv e Veff

$sen\, ldr = \dfrac{V_c}{V_p}\, sen(A_c - R_v) = -0{,}131918593$; $ldr = -7{,}6°$; $\begin{array}{l} R_V = 040° \\ -ldr = +\ 7{,}6° \\ \hline P_V = 47{,}6° \end{array}$

$$\begin{array}{l} Ae = 278° \\ -P_V = -\ 47{,}6° \\ \hline (Ae - P_V) = 230{,}4° \end{array} \qquad V_{eff} = \sqrt{V_p^2 + V_c^2 + 2V_pV_c\cos(Ae - P_V)} = 8{,}179 \; ; \; V_{eff} = 8{,}2 \text{ nodi}$$

$tag\,\delta g = \dfrac{-V\cos R_V}{900\cos\varphi} = -0{,}009265936$; $\delta g = -0{,}5°$ $\qquad \begin{array}{l} P_V = 47{,}6° \\ -\delta g = +\ 0{,}5 \\ \hline P_g = 48{,}1° \end{array}$

Quesito F

NAVE X

$P_v = 314°$
$+ \delta = -48$
$R_v = 266°$

NAVE Y

$P_v = 314°$
$+ \delta = +66°$
$R_v = 380°$
$R_v = 20°$

BOA

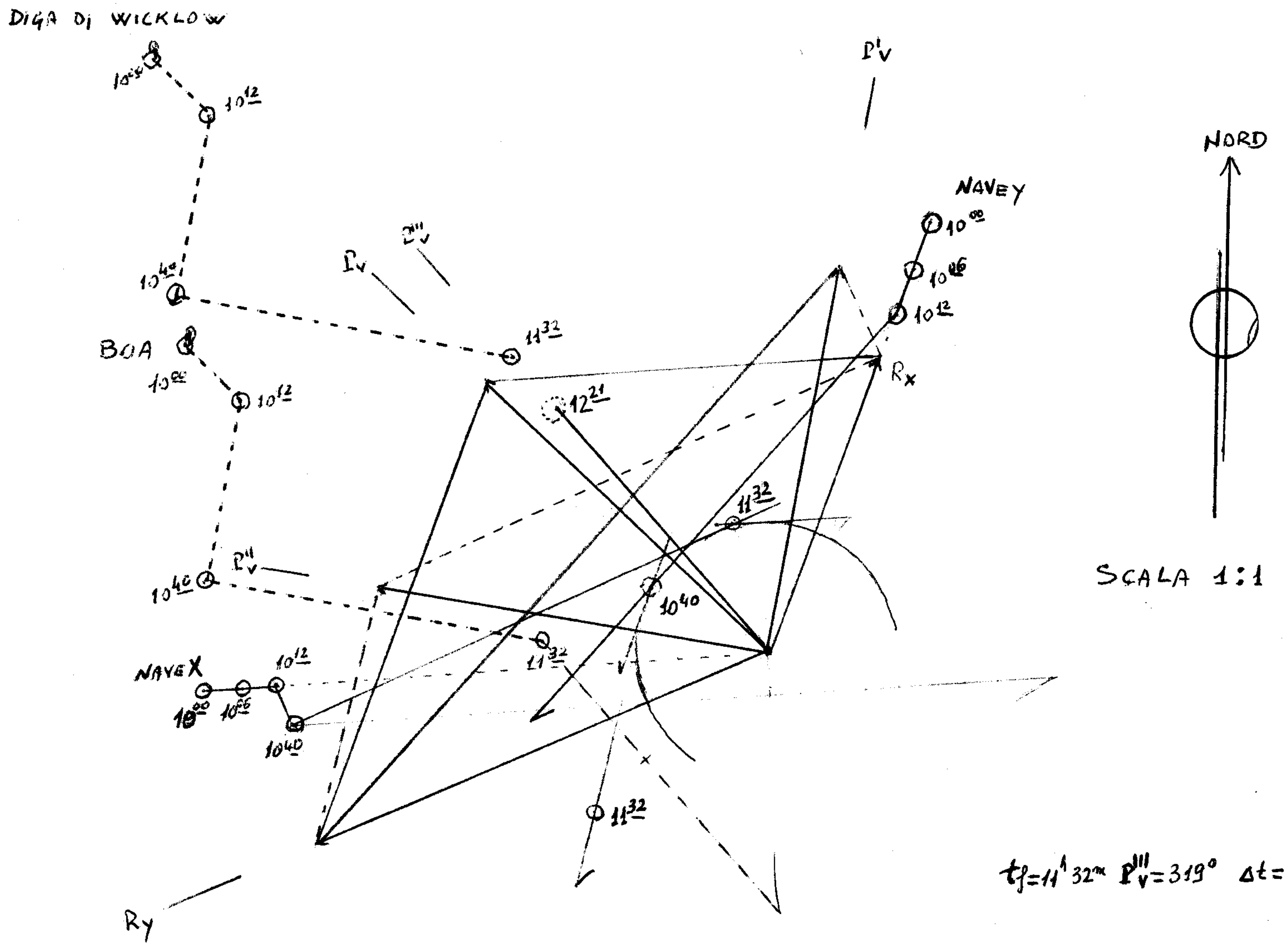
$P_v = 314°$
$- \delta = -16$
$R_v = 298°$

RISPOSTA AI QUESITI

1) $P_v = 319°$

2) CPA BOA mg 2,5

3) $t_f = 12^h 21^m$



$t_f = 11^h 32^m$ $P'''_v = 319°$ $\Delta t = \frac{4,9}{6} = 0^h,81 = 49^m$

$R_{vx} = 20°$
$V_x = 4,8$ nodi
$R_{vy} = 247°$
$V_y = 7,5$ nodi

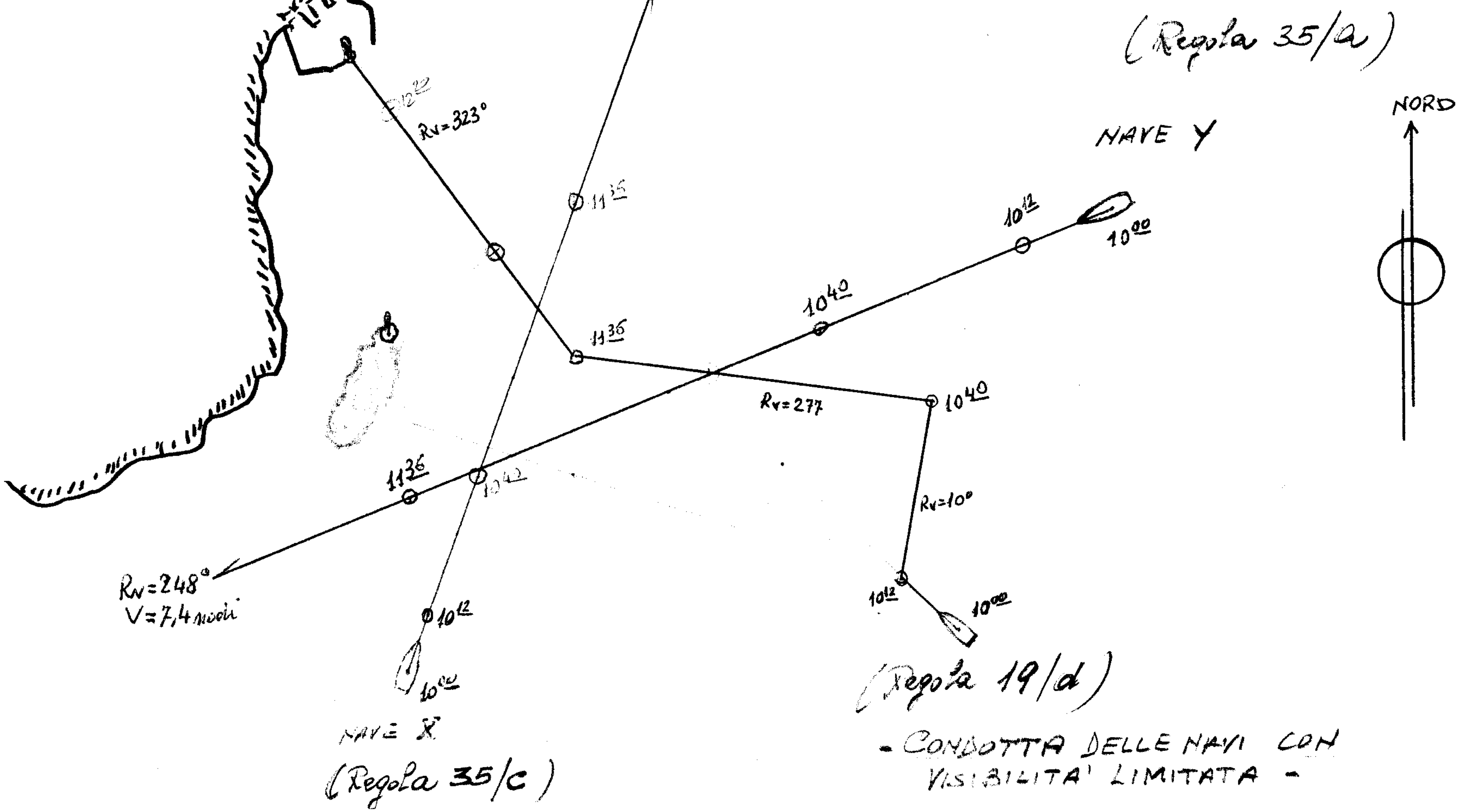
$t_f = 10^h 12^m$ $P'_v = 10°$ $V_{ry} = 11,9$ nodi $\Delta t = \frac{5,6}{11,9} = 0^h,46 = 28^m$

$V_{rx} = 1,5$ nodi $m = 0,46 \cdot 1,5 = 0,69$ mg

$t_f = 10^h 40^m$ $P''_v = 280°$ $\begin{cases} V_{rx} = 8,4 \text{ nodi} \\ V_{ry} = 4 \text{ nodi} \end{cases}$ $\Delta t = \frac{7,3}{8,4} = 0^h,86 = 52^m$

$m = 0,86 \cdot 4 = 3,44$ mg

REGOLA 35: SEGNALI SONORI IN CONDIZIONI DI VISIBILITA' RIDOTTA



SCALA 1:1

Quesito G

A) Where possible I would compare one instrument with another to identify an error, that is check the giro with the standard compass, the GPS with a radar or celestial fix.

B) P_s per le osservazioni astronomiche:

P_s (φ_s = 17° 23',5 N ; λ_s = 137° 01',5 E)

Controllo Bussole : φ_s = 17° 23',5 N ; $\delta_\odot$ = 02° 33' S

$\text{sen } Amp = \frac{\text{sen } \delta}{\cos \varphi} = 0,046622613$; Amp = W 02,6° S Av = 267,7°

+ c = − 0,3° − A_b = −270,0°

$Amp_\odot$ = W 2,3° S Vm = − 2,3°

$c = 55' \frac{\tan \varphi}{\cos Amp} \approx 0,3°$

P_{BM} = 15,5°
+ Vm = − 2,3
P_V = 13,2°

$t_{f\,app}$ = 18h 40m del 14/3
− λ_f = − 9h
$T_{m\,app}$ = 9h 40m del 14/3

SIRIO δ = − 16° 42',8

Tc = 9h 36m 40s	hi = 55° 04',6
+ K = + 10s	+ γe = + 2',2
Tm = 9h 36m 50s	ho = 55° 06',8
T's = 306° 45',3	14,4
+ λ_s = + 137° 01',5	39,3
t's = 83° 46',8	hv = 55° 00',5
cod = 258° 46',3	− hs = − 54° 56',9
Is = 9° 14',0	Δh = + 3',6
t* = 351° 47',1	+ e = − 2',0
P_E = 8° 12',9	Δh = + 1',6
	Qs = 166,2°

CAPELLA δ = + 45° 59',6

Tc = 9h 38m 05s	hi = 59° 02',6
+ K = + 10s	+ γe = + 2',2
Tm = 9h 38m 15s	ho = 59° 04',8
	14,4
t's = 83° 46',8	39,4
cod = 280° 55',8	hv = 58° 58',6
Is = 9° 35',3	− hs = − 59° 01',8
t* = 374° 17',9	Δh = − 3',2
P_W = 14° 17',9	+ e = + 1',3
	Δh = − 1',9
	Qs = 340,5°

(Astro X) REGOLO $\delta = +11°59',5$, MENKAR $\delta = +4°03',9$

REGOLO

$T_c = 9^h\,41^m\,20^s$	$h_i = 34°\,05',2$
$+K = +\quad 10^s$	$+\gamma_c = +\quad 2',2$
$T_m = 9^h\,41^m\,30^s$	$h_o = 34°\,07',4$
	$14,4$
$t'_s = 83°\,46',8$	$38,6$
$Cod = 207°\,58',5$	$h_v = 34°\,00',4$
$I_s = 10°\,24',2$	$-h_s = -33°\,59',0$
$t_* = 302°\,09',2$	$\Delta h = +\quad 1',4$
$P_E = 57°\,50',2$	$+C = +\quad 0,1$
$Q_s = 87°$	$\Delta h = +\quad 1',5$

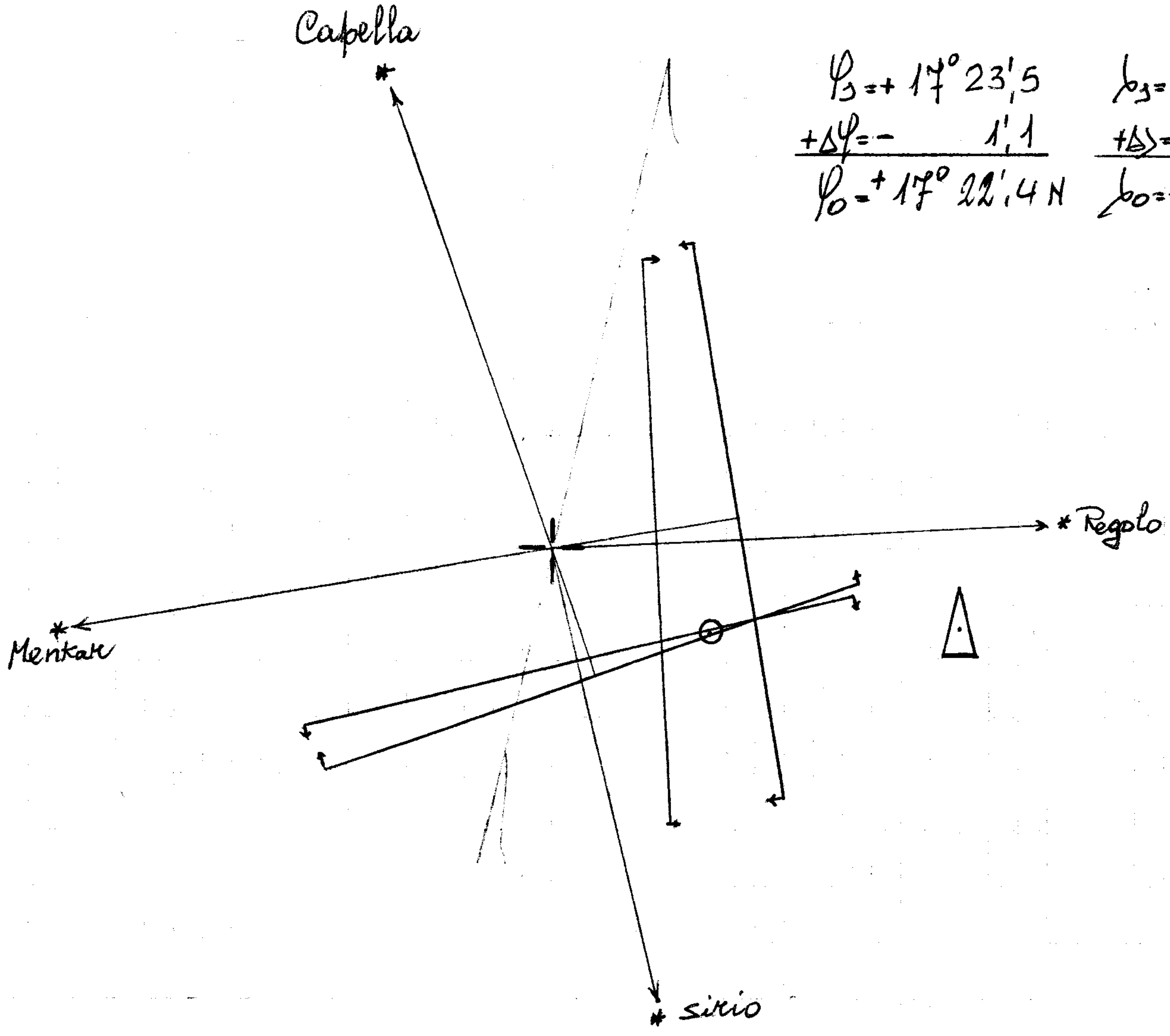
MENKAR

$T_c = 9^h\,43^m\,42^s$	$h_i = 39°\,59',0$
$+K = +\quad 10^s$	$+\gamma_c = +\quad 2',2$
$T_m = 9^h\,43^m\,52^s$	$h_o = 40°\,01',2$
	$14,4$
$t'_s = 83°\,46',8$	$38,8$
$Cod = 314°\,30',3$	$h_v = 39°\,54',4$
$I_s = 10°\,59',8$	$-h_s = -39°\,57',1$
$t_* = 409°\,16',9$	$\Delta h = -\quad 2',7$
$P_W = 49°\,16',9$	
	$Q_s = 260,5°$

$1'\varphi = 1$ cm

$1'\lambda = 0,95$ cm

$\varphi_s = +17°\,23',5$	$\lambda_s = +137°\,01',5$
$+\Delta\varphi = -\quad 1',1$	$+\Delta\lambda = +\quad 2',4$
$\varphi_o = +17°\,22',4$ N	$\lambda_o = +137°\,03',9$ E



Metodo dei minimi quadrati

(Vedi - Franco Esposito : Determinazione del punto nave con la retta d'altezza Saint-Hilaire mediante il metodo dei minimi quadrati - Ellisse di probabilità - GDOP (Geometric Dilution of Precision)).
- Laboratorio di Navigazione - I.T.N.S. "Duca degli Abruzzi" - Bagnoli (NA) -

Sirio	:	$a_1 = 166{,}2°$	$\overline{\Delta h_1} = +1',6$
Capella	:	$a_2 = 340{,}5°$	$\overline{\Delta h_2} = -1',9$
Regolo	:	$a_3 = 87{,}0°$	$\overline{\Delta h_3} = +1',5$
Menkar	:	$a_4 = 260{,}5°$	$\Delta h_4 = -2',7$

$A = \cos^2 a_1 + \cos^2 a_2 + \cos^2 a_3 + \cos^2 a_4 = 1{,}861654535$

$B = \cos a_1 \operatorname{sen} a_1 + \cos a_2 \cdot \operatorname{sen} a_2 + \cos a_3 \operatorname{sen} a_3 + \cos a_4 \operatorname{sen} a_4 = -0{,}331259904$

$C = \operatorname{sen}^2 a_1 + \operatorname{sen}^2 a_2 + \operatorname{sen}^2 a_3 + \operatorname{sen}^2 a_4 = 2{,}138345465$

$D = \overline{\Delta h_1} \cos a_1 + \overline{\Delta h_2} \cos a_2 + \overline{\Delta h_3} \cos a_3 + \Delta h_4 \cos a_4 = -2{,}820701211$

$E = \overline{\Delta h_1} \operatorname{sen} a_1 + \overline{\Delta h_2} \operatorname{sen} a_2 + \overline{\Delta h_3} \operatorname{sen} a_3 + \Delta h_4 \operatorname{sen} a_4 = 5{,}176801991$

$F = \overline{\Delta h_1}^2 + \overline{\Delta h_2}^2 + \overline{\Delta h_3}^2 + \Delta h_4^2 = 15{,}71$

$$\Delta\varphi = \frac{D \cdot C - B \cdot E}{AC - B^2} = \frac{-4{,}316766712}{3{,}871127408} = -1{,}115118 \simeq -1',1$$

$\varphi_s = +17°\,23',5$
$+\Delta\varphi = -\quad 1',1$
$\varphi_0 = +17°\,22',4\ N$

$$\Delta\lambda = \frac{A \cdot E - D \cdot B}{(AC - B^2)\cos\varphi_s} = \frac{8{,}703031691}{3{,}69415422} = 2{,}35589 \simeq +2',4$$

$\lambda_s = +137°\,01',5$
$+\Delta\lambda = +\quad 2',4$
$\lambda_0 = +137°\,03',9\ E$

Calcolo degli elementi dell'ellisse unitaria (probabilità 39,34%)

$$\sigma = \sqrt{\frac{F - D \cdot \Delta\varphi - E \cos\varphi_0 \cdot \Delta\lambda}{n-2}} = \sqrt{\frac{0,749708978}{2}} =$$

$$= 0,61225 \cong 0,61 \text{ mg.}$$

$$\operatorname{tag} 2\theta = \frac{2 \cdot B}{(A - C)} = 2,394439919 \; ; \; 2\theta \cong 67,33^\circ$$

$$a = \frac{\sigma}{\sqrt{\frac{n}{2} - \frac{B}{\operatorname{sen} 2\theta}}} \cong 0,4 \text{ mg} \; ; \; b = \frac{\sigma}{\sqrt{\frac{n}{2} + \frac{B}{\operatorname{sen} 2\theta}}} \cong 0,5 \text{ mg.}$$

A questo punto, per calcolare il semiasse maggiore (b') e quello minore (a') dell'ellisse di probabilità 68%, vedi:

Esposito Franco - Errori a due dimensioni. Applicazioni al Punto NAVE - (Atti dei Corsi di Aggiornamento: "NUOVE TECNICHE DI NAVIGAZIONE". I.T.N.S. - Duca degli Abruzzi - anno 1981)

Dalla TAV. I (pag. 123) ⟶ $C = 1,53$

$$a' = 0,4 \cdot 1,53 = 0,612 \text{ mg.} \; ; \; b' = 0,5 \cdot 1,53 = 0,765$$

$$d_{rms} = \sqrt{(a')^2 + (b')^2} = 0,979 \simeq 1 \text{ mg.}$$

Risposte

1) Il punto satellitare è più affidabile perché il suo errore radiale (drms) è più piccolo di quello delle rette d'altezza. Infatti:

(G.P.S.) drms = (HDOP)·σ = 3·45 = 135 metri

(Astronomia) drms = 1 mg.

2) Il parametro considerato è l'errore radiale (drms). Quando, nella pratica, si vogliono confrontare le incertezze di punti ottenuti con procedimenti diversi, senza riguardo all'andamento direzionale(1) delle stesse, può essere fatto uso dell'indice (drms). (pag. 133 - Atti dei Corsi di Aggiornamento)

3) Poca affidabilità è da porsi sulla retta di Regolo: l'astro è osservato a levante ove, per l'accumulo di nubi, l'orizzonte è da supporsi "incerto".

4) Dal controllo delle bussole poco prima delle osservazioni astronomiche (o del punto satellitare) si accerta un errore nella Vm inclusa nella conversione della Pv, per cui la nave ha navigato

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(1) Vedi anche: Giancarlo Lucarelli - Sistemi di Navigazione a Multilaterazione, sferici, iperbolici, pseudosferici. Sistema satellitare NAVSTAR G.P.S. La precisione ed il calcolo del punto. - Monografie di Astronomia Nautica satellitare - I.U.N. Napoli 1986 -

per $P_V = 13°$ anziché $P_V = 10°$.

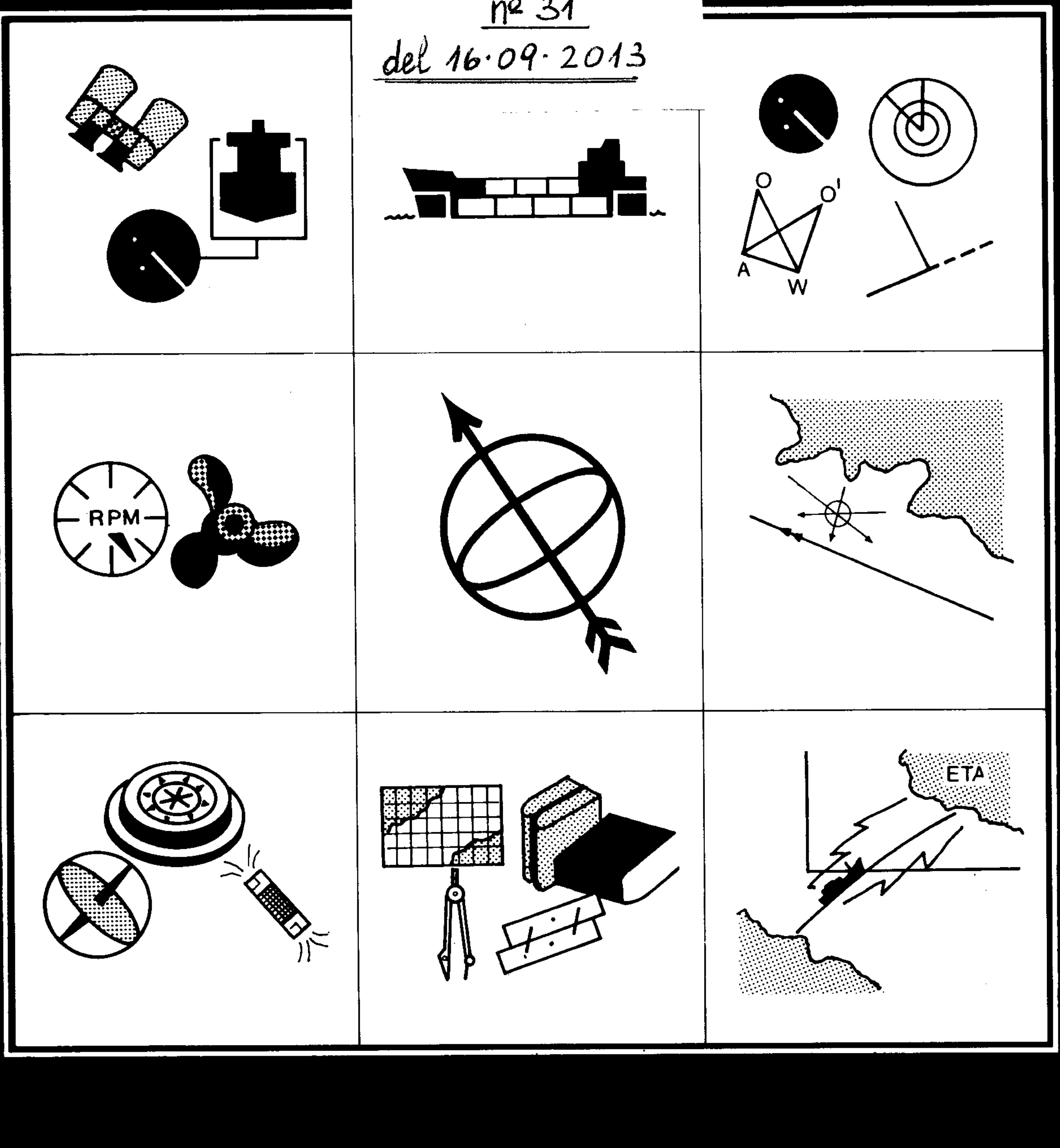
Ma richiamo l'attenzione sul G.P.S. :

a) Some GPS receivers, manufactured before 2000, may have an error in program due to the first "roll over" of the 1024 week GPS clock cycle which occurred at midnight on 21st Aug. 1999 or due to a Y2K (year 2000 - computer program problem) or due to some other reason (if there is any problem call a GPS manufacturer). It is important for the mariner to read carefully the GPS Operator Manual.
The prudent mariner will not rely solely on any GPS receiver, particularly not close to coast (Punto A)

b) GPS receivers keep The Coordinated Universal Time (UTC), but this time is not accurate as UTC obtained from a Radio Shore station. A maximum difference between them of two seconds was found. If a vessel has two GPS receivers, the difference between their UTC times is, in the most cases, within two seconds. The difference in UTC between the accurate UTC (the Radio Shore Station) and UTC from GMDSS receiver is, in the most cases, within 15 seconds. The difference in UTC between two GMDSS receivers may be a few seconds. The difference in UTC between the accurate UTC and UTC from VHF transceiver is, in the most cases, within 30 seconds. To find a Chronometer error use a Time Signal from the Radio Shore Station.

c) If a vessel has two GPS receivers, their GPS positions on the receiver's screen can differ (in the most cases up to 0,01') due to distance between the GPS antennas (GPS antennas have different positions).

BRIDGE TEAM MANAGEMENT



A practical guide

by

Captain A J Swift MNI