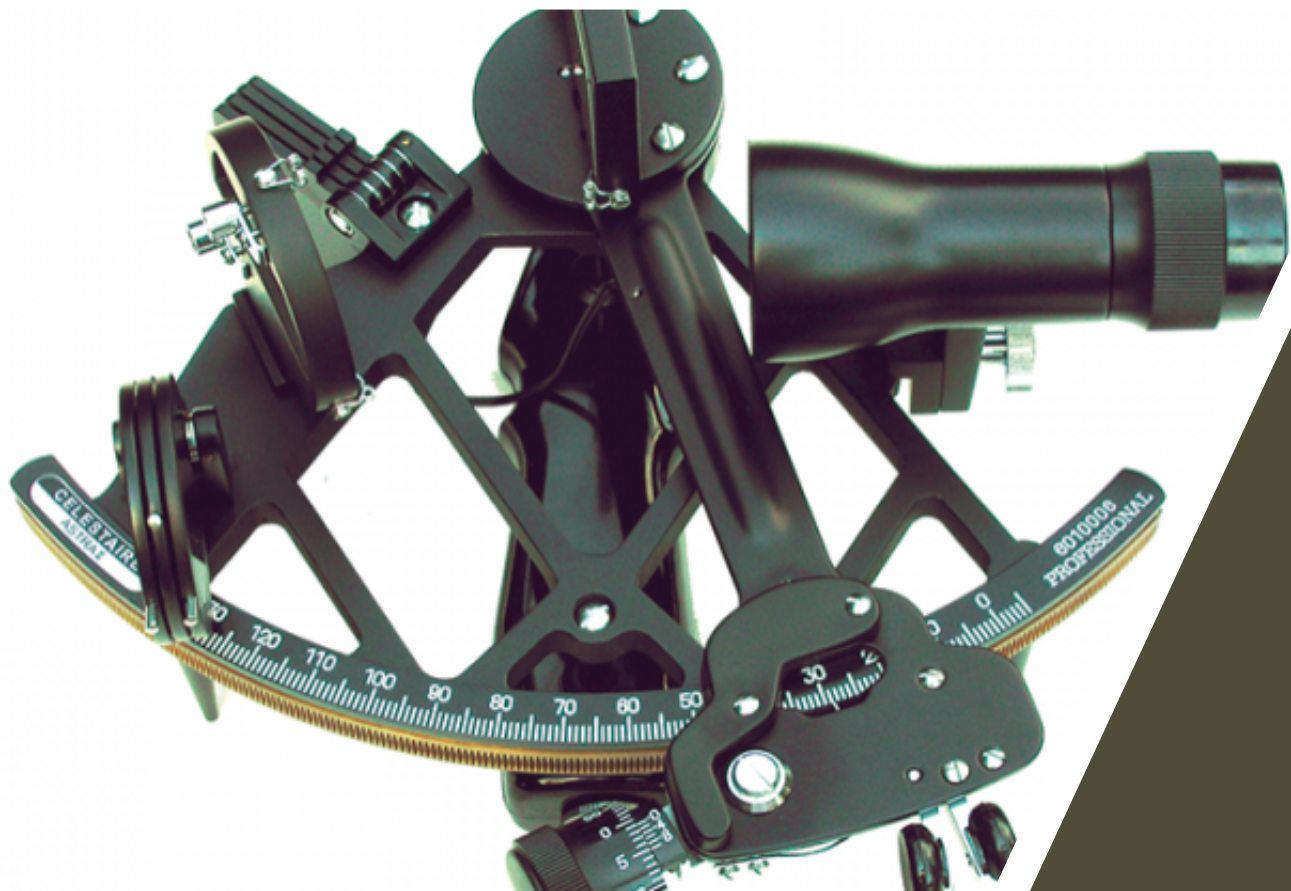
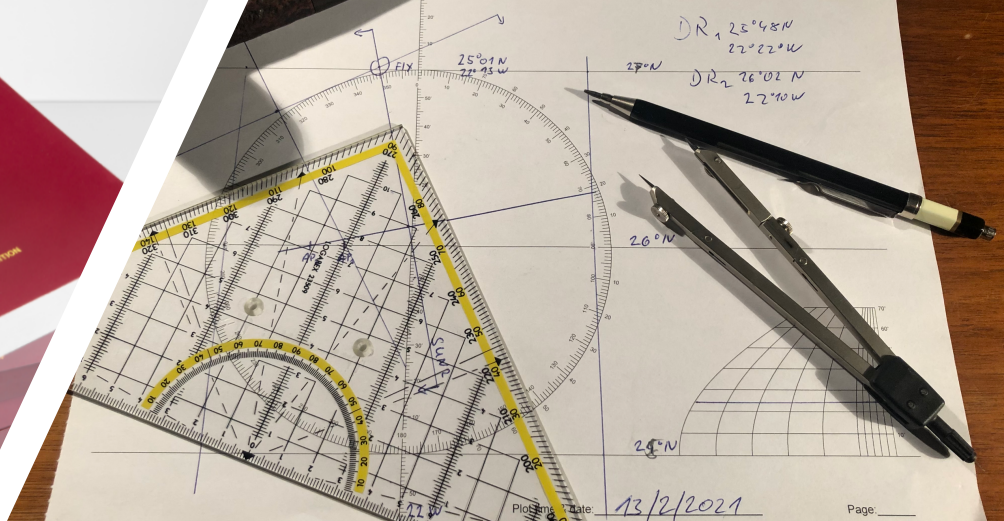
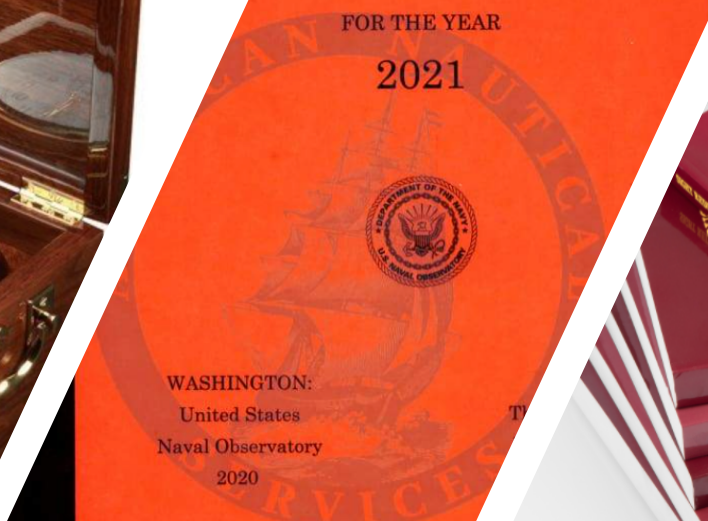


Astronavigace pro začátečníky (od začátečníka)





Proč astronavigace?



Co je potřeba?

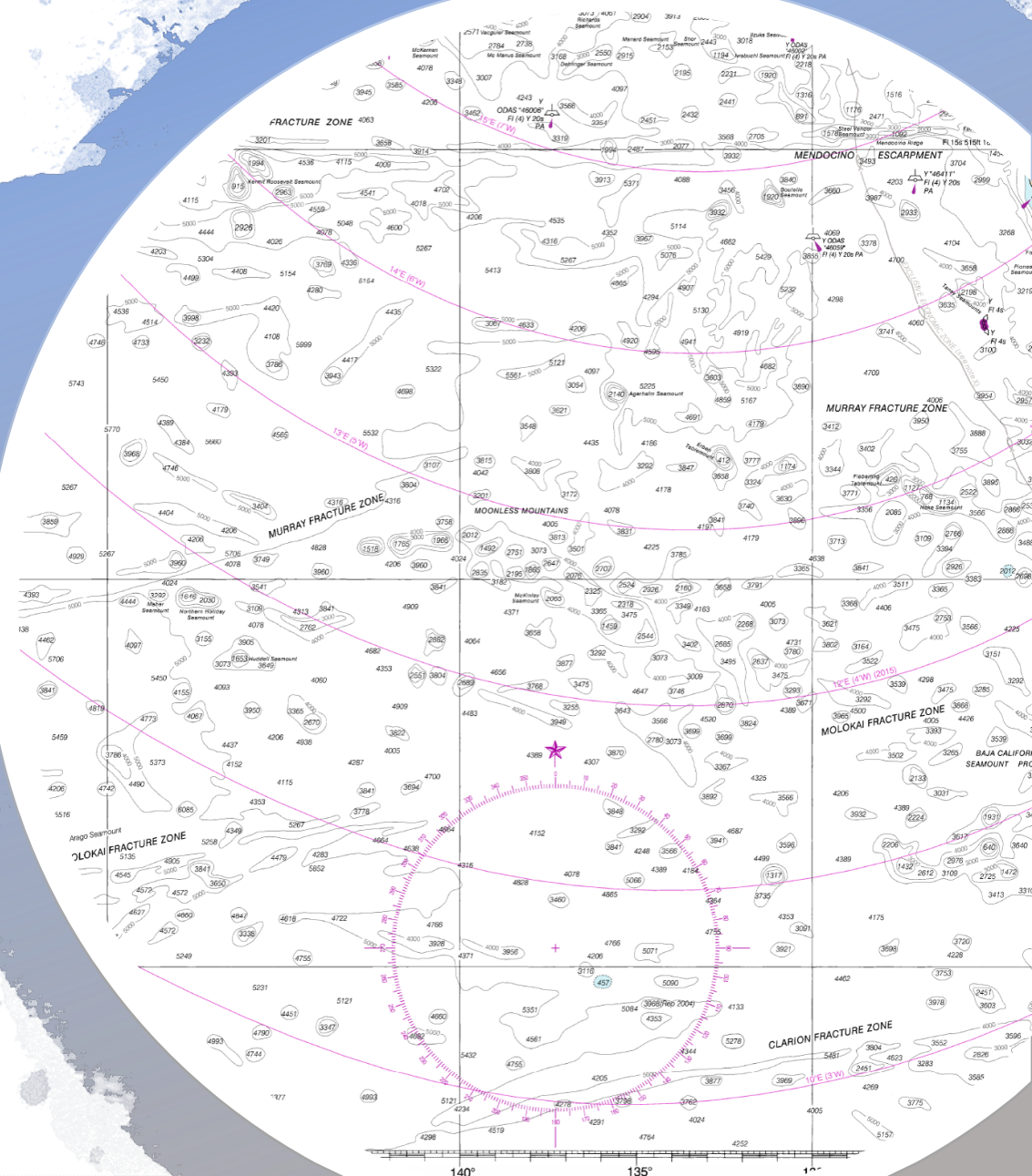
Přesnost astronavigace

Vlivy

- Omezení sextantu
 - 0,2 Nm
- Přesnost měření
 - Stav moře
 - Počasí
- Přesnost výpočtů
 - zaokrouhlení

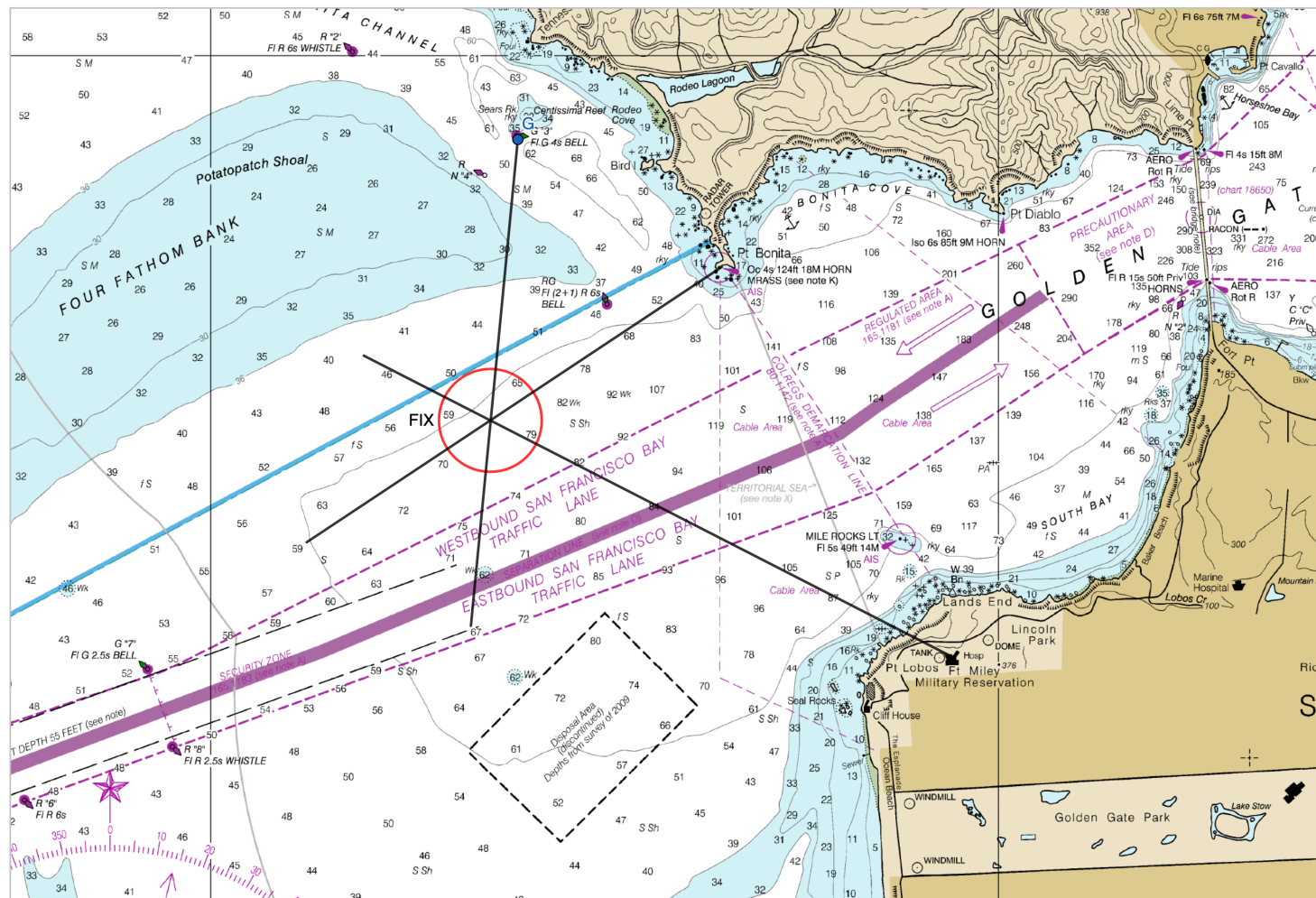
Přesnost určení polohy

- Zkušený navigátor
 - 1 – 2 Nm
- Průměrný navigátor
 - 5 Nm
- Začátečník
 - 10 – 15 Nm



Určení pozice – terestrická navigace

- Náměr dvou bodů
- Vykreslení bodů do mapy
- Určení FIX v průsečíku

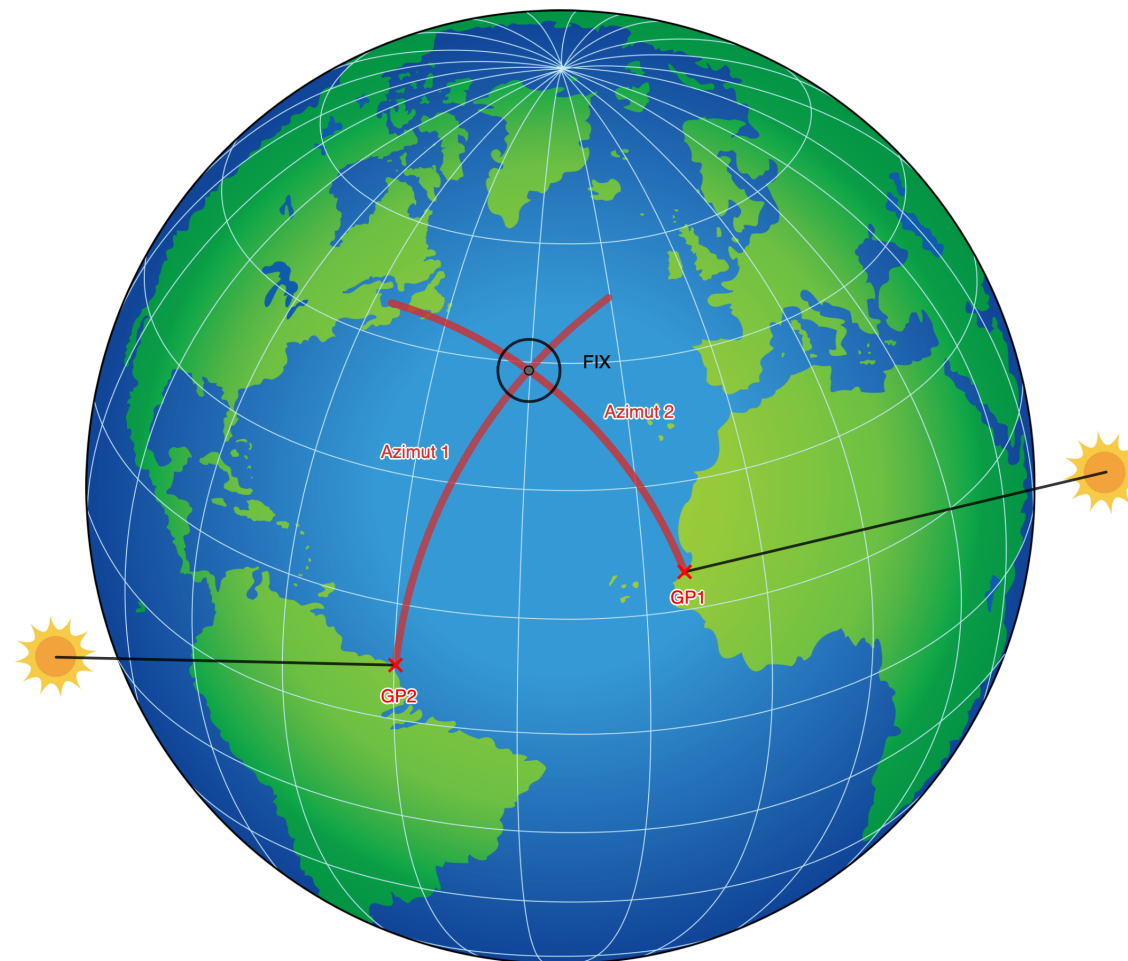


Určení pozice – astronavigace

- Náměr dvou bodů
- Určení FIX v průsečíku

Problém

- NELZE zakreslit do mapy

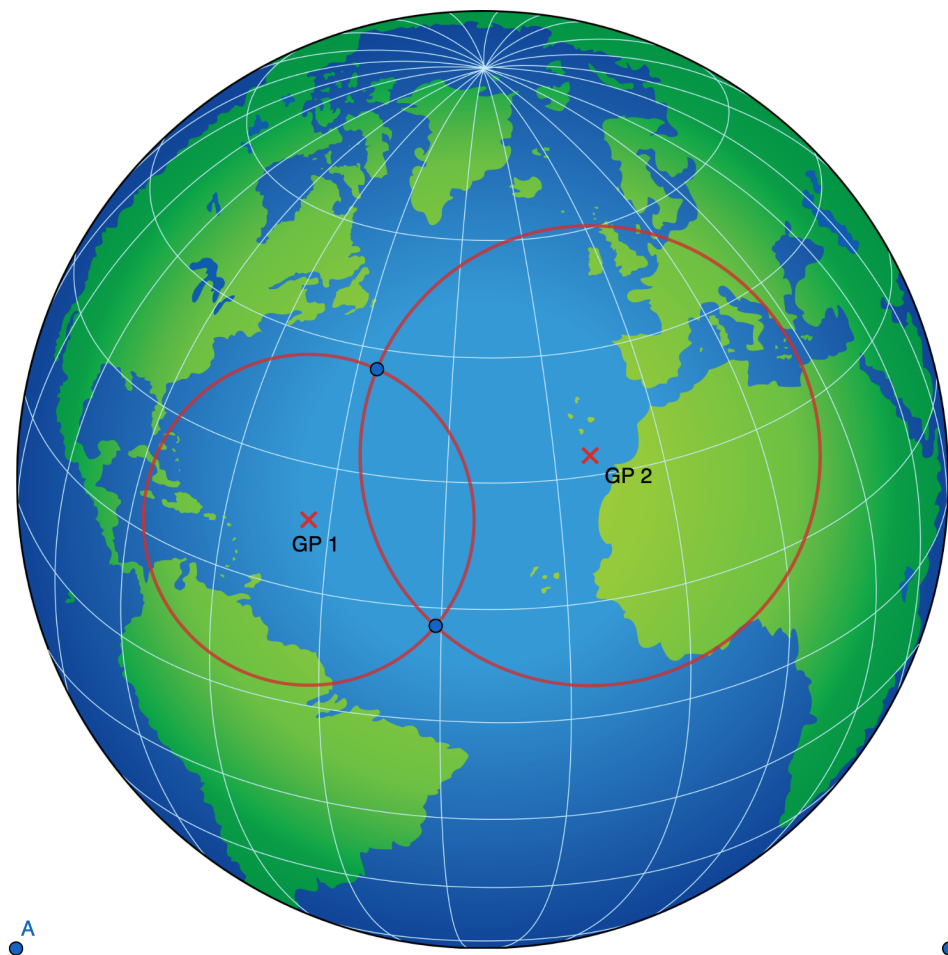


Určení pozice – astronavigace

- Vzdálenost dvou bodů
- Určení FIX v průsečíku kružnic

Problém

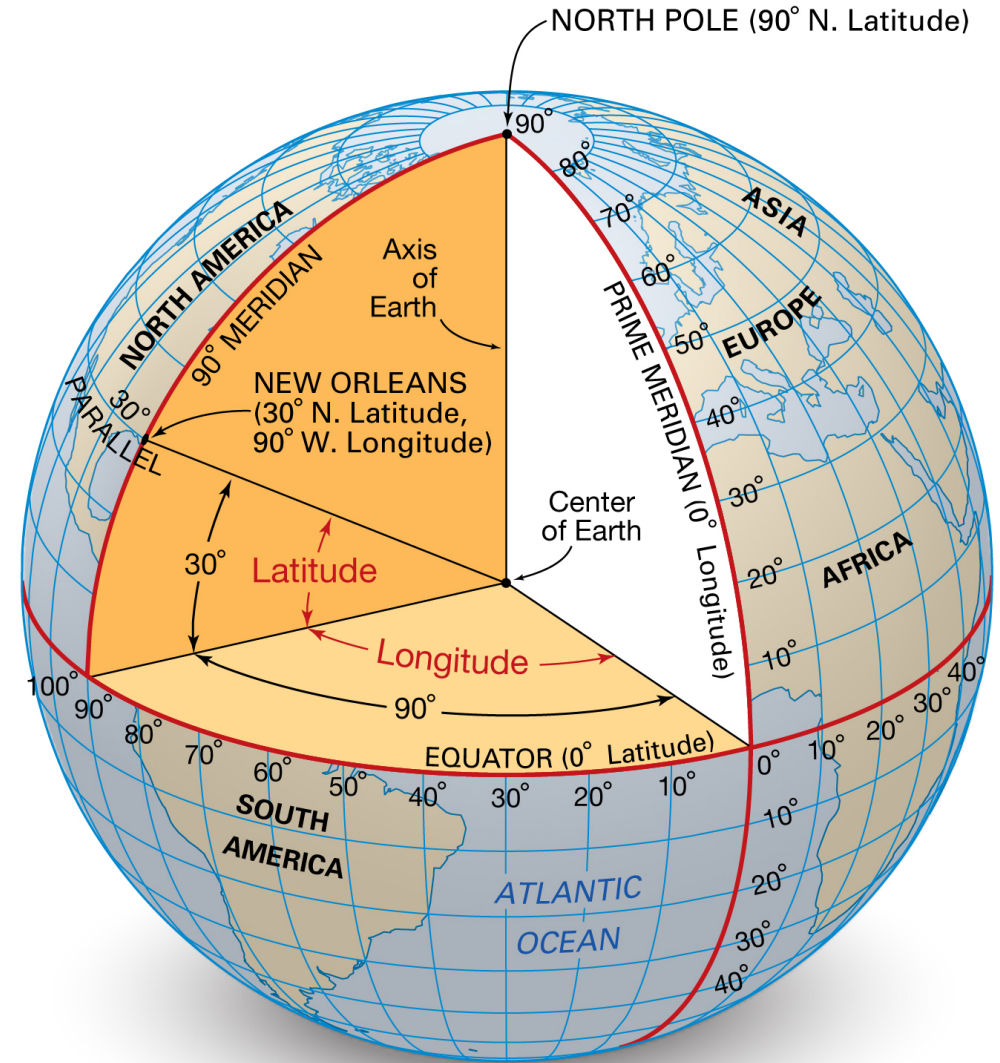
- NELZE zakreslit do mapy
- Dvě možné polohy



Souřadnice

System souřadnic – systém 360°

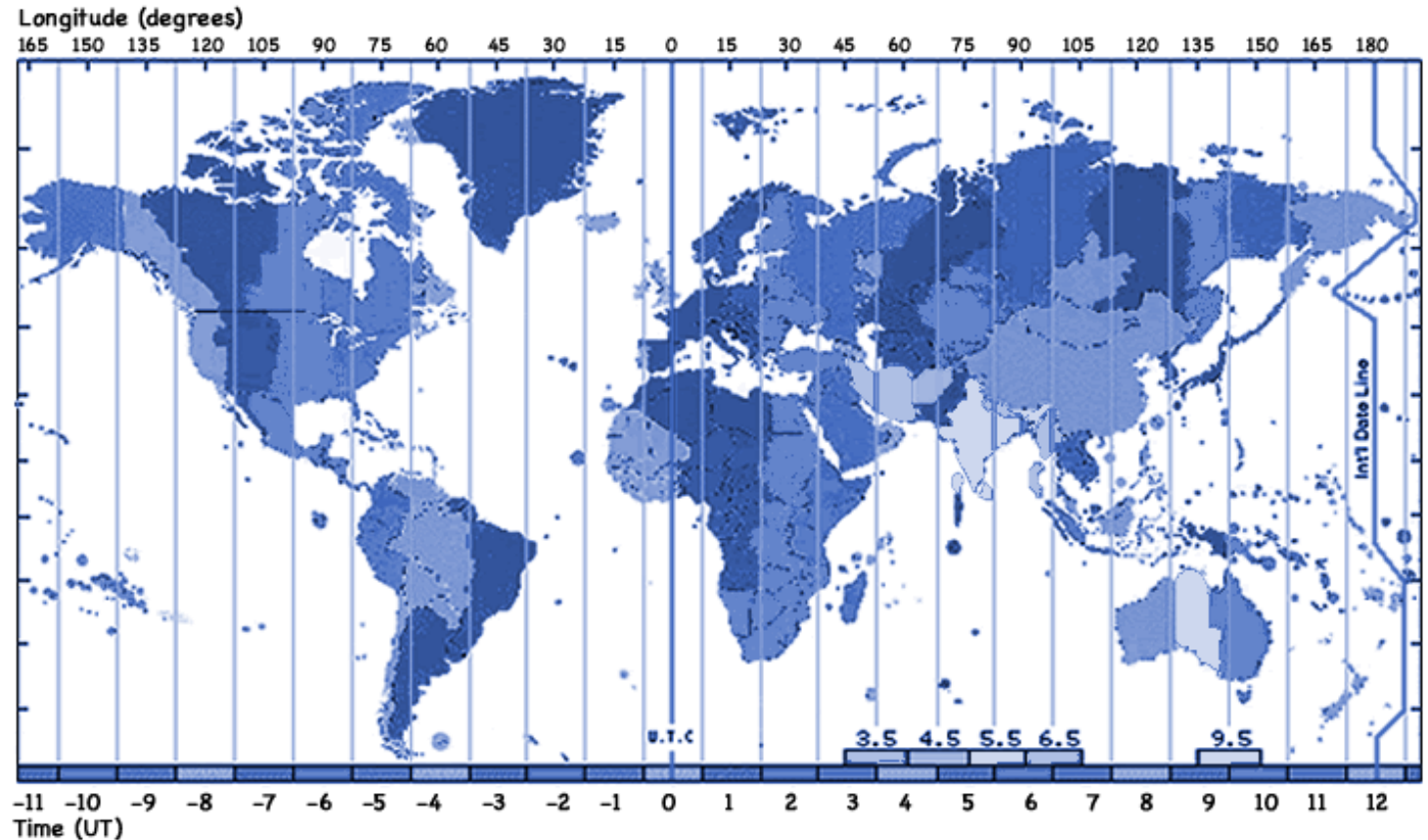
- Zeměpisná šířka – latitude - rovnoběžky
 - Severní polokoule
 - Jižní polokoule
- Zeměpisná délka – longitude - poledníky
 - Západní délka
 - Východní délka
- Jednoznačné určení polohy na zeměkouli
 - Praha
 - 50° 50' N
 - 014° 25' E
- Důležité
 - Rovník = Equator 0° lat.
 - Nultý poledník = Prime meridian 0° long.



Čas

- GMT – Greenwich Mean Time
- UT – United Time
- UTC – United Time Coordinated
- GMT = UT = UTC
 - Přibližně
 - Pro potřebu astronavigace dostačující
- Lodní čas = Local Time
 - Čas upravený dle časové zóny
- Oběh slunce
 - 1 den = 1 “oběh” slunce okolo země
 - 24 hodin = $360^\circ = 21\,600'$
 - 1 hodina = $15^\circ = 900'$
 - 1 minuta = $15' = 15\text{ Nm}$

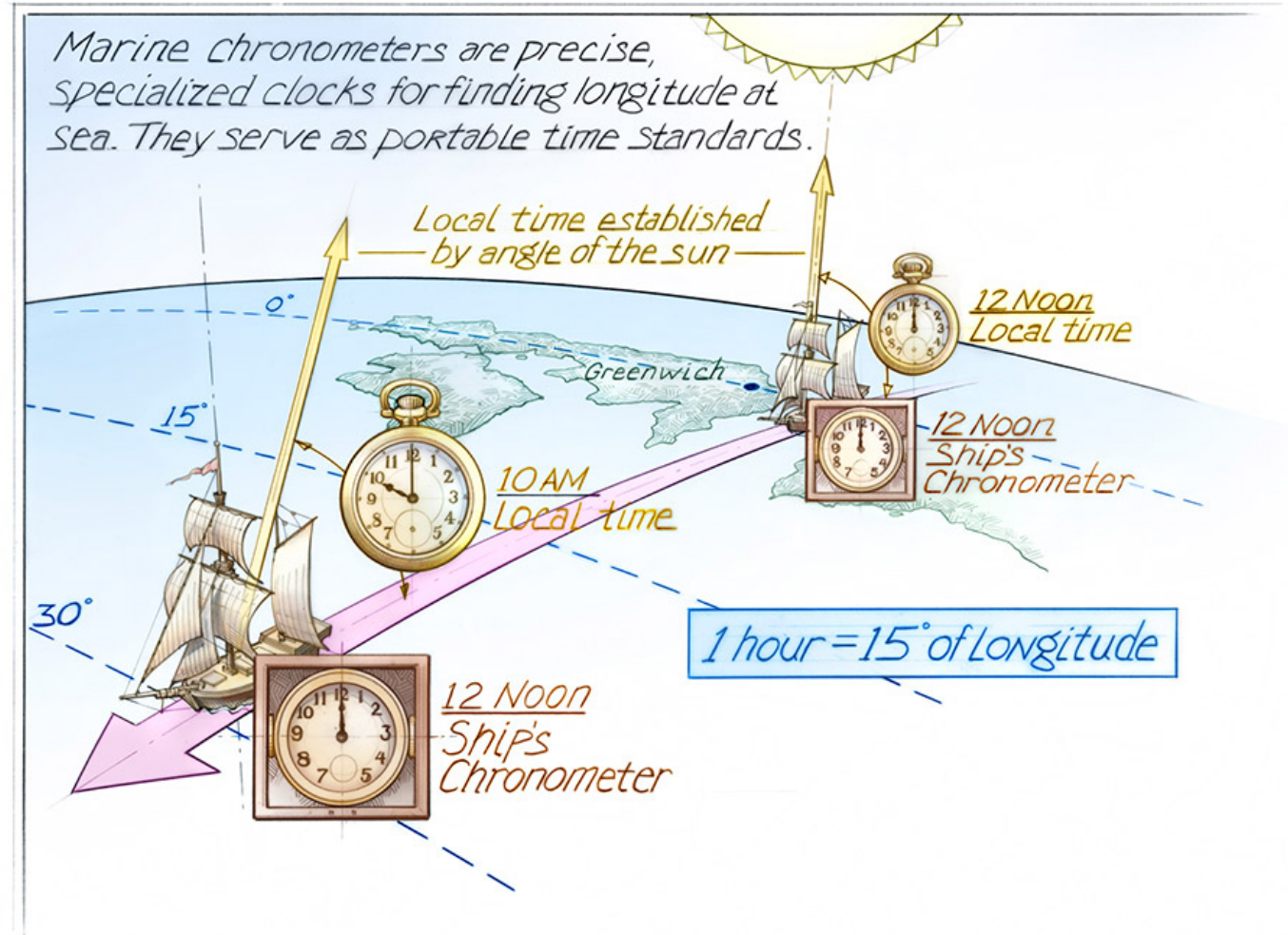
Time and Longitude



Určování času

- Zdroj přesného UT
 - Námořní chronometr
 - GPS
 - Rádio
 - Internet
- Kvalitní digitálky
 - Minimální odchylka
 - Cca 5 sekund / měsíc
- Lodní hodiny
 - Upravené dle časové zóny
- Hodiny pro astronavigaci
 - Přesný UT

USING A MARINE CHRONOMETER

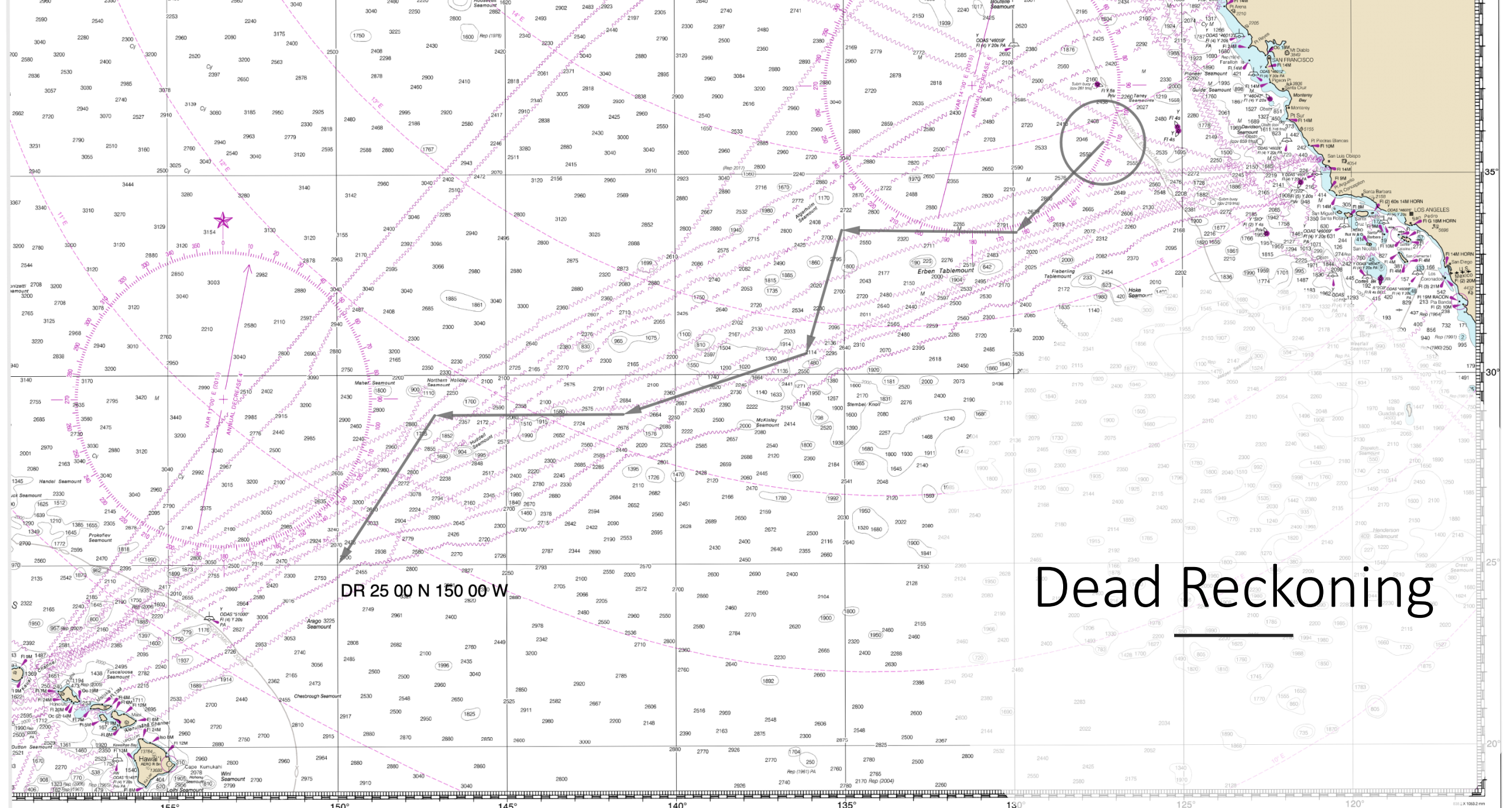


10 000 USD



100 USD





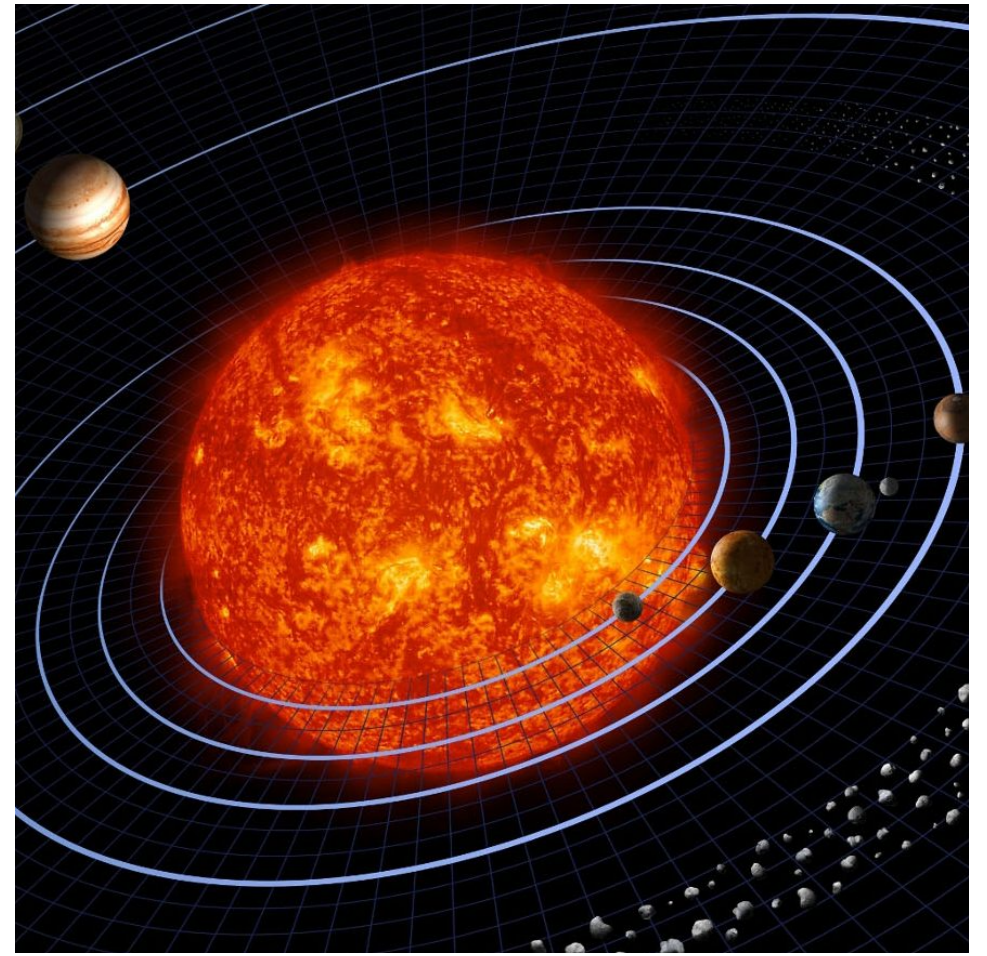
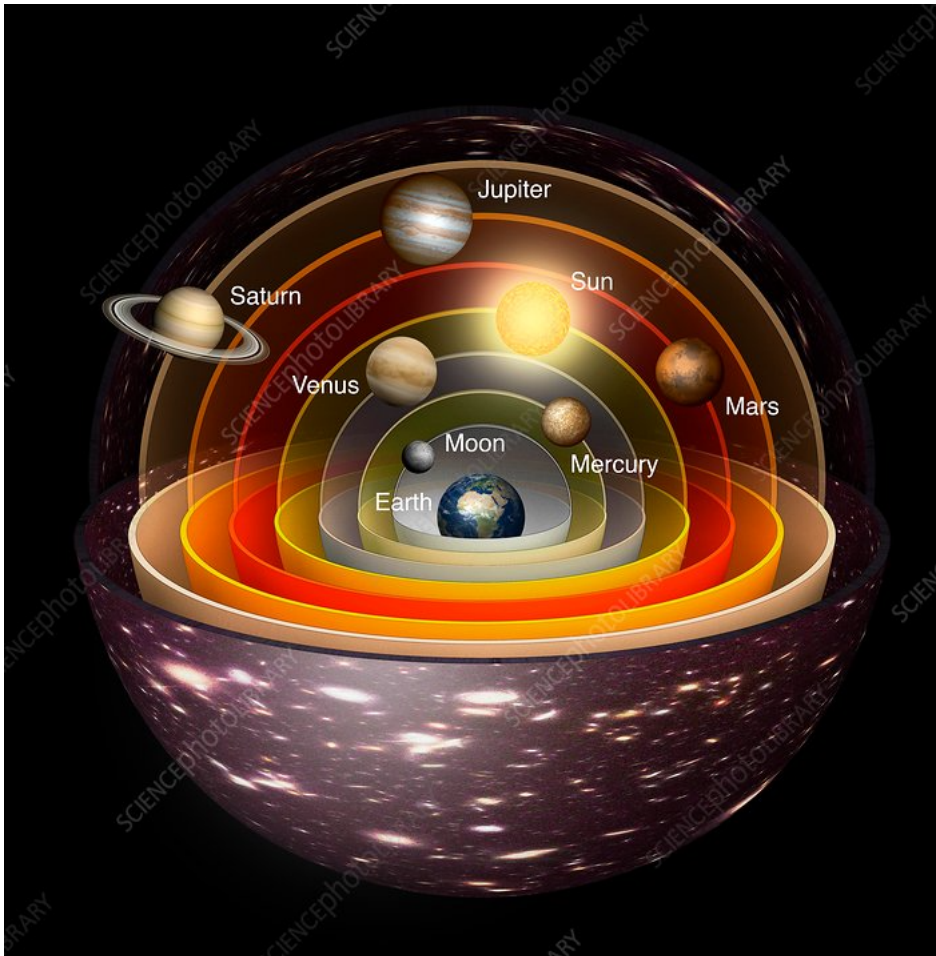
DR 25 00 N 150 00 W

Dead Reckoning

155° 150° 145° 140° 135° 130° 125° 120°

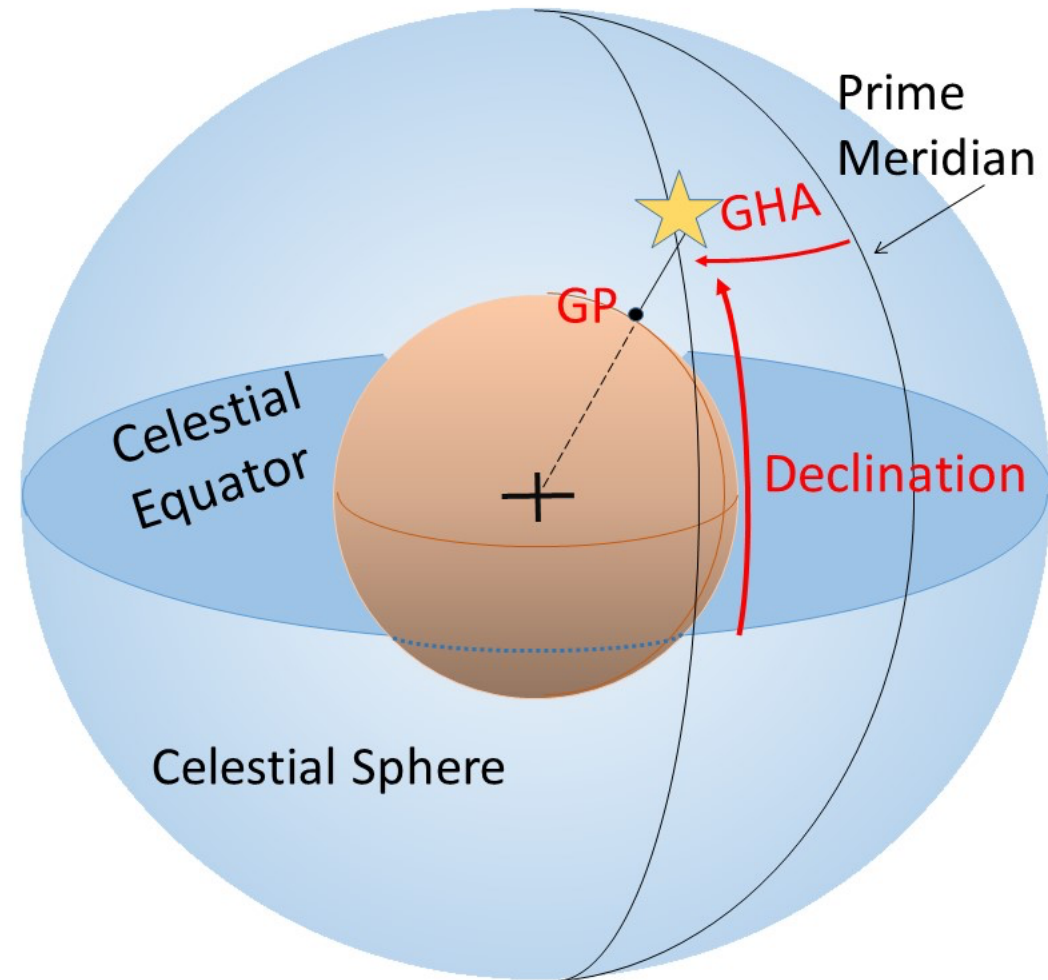
1:50,000

Geocentrický vs. heliocentrický model



Geocentrický model

- Pro astronavigaci používáme geocentrický model
- Každé těleso na nebeské sféře má bod, kde to dané těleso vidíme přímo nad hlavou
 - Zenit – těleso je přímo nad hlavou
 - Nadir – těleso je přímo pod nohama (nevidíme jej)
- Bod, kde máme těleso přímo nad hlavou se nazývá Geographic position (GP)
- Souřadnice GP vyjadřujeme jako GHA a Declination

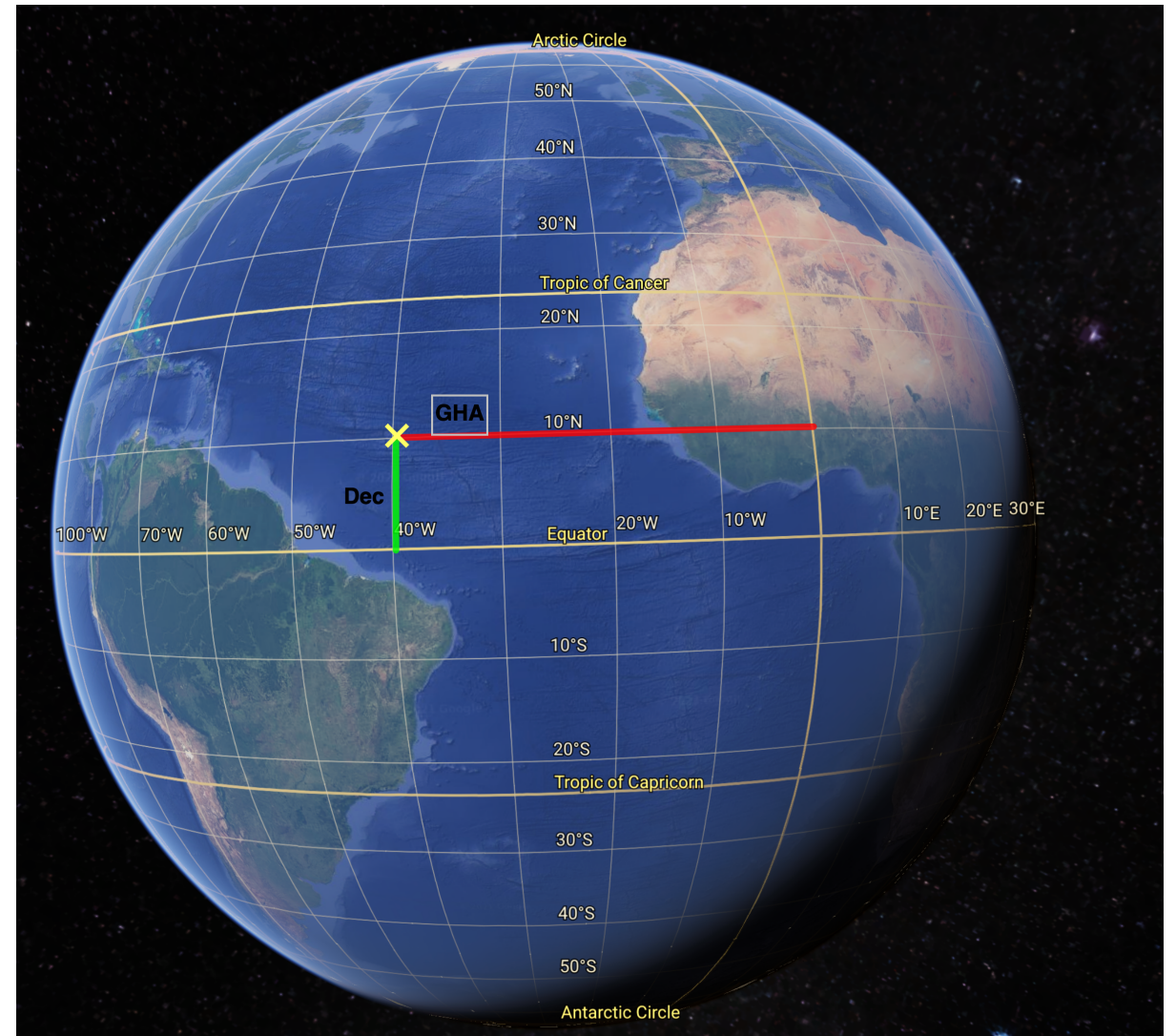


GP v průběhu dne



Pozice GP = Dec / GHA

- GHA = Greenwich Hour Angle
- Longitude převedený na 360°
 - W longitude = GHA
 - E longitude => $GHA = 360^\circ - E \text{ long}$
- Declination
 - Pozice v zeměpisné šířce
 - North
 - South
- Praha
 - $50^\circ 50' \text{ N}$
 - $014^\circ 25' \text{ E} = (360^\circ - 014^\circ 25') = GHA 345^\circ 35' \text{ W}$
- Pozici GP zjistíme z Nautical Almanac



Matematika v astronavigaci

Excerpt from *Norie's Tables*.

TABLE VIII.
Dip at differ. Distances
from the Observer.

Height of the Eye in Feet.					
5	10	15	20	25	30
11'	23'	34'	45'	57'	68'
6	12	17	23	28	34
4	8	12	16	19	23
3	6	9	12	15	17
3	5	7	10	12	14
3	4	6	8	10	12
2	4	5	7	8	9
2	3	4	6	7	8
2	3	4	5	6	7
2	3	4	5	6	6
2	3	4	5	5	6
2	3	4	4	5	6
2	3	4	4	5	5

Table Reference

$N :=$

	Height (ft)					
Miles	5	10	15	20	25	30
0.25	11	23	34	45	57	68
0.5	6	12	17	23	28	34
0.75	4	8	12	15	19	23
1	3	6	9	12	15	17
1.25	3	5	7	10	12	14
1.5	3	4	6	8	10	12
2	2	4	5	7	8	9
2.5	2	3	4	6	7	8
3	2	3	4	5	6	7
3.5	2	3	4	5	6	6
4	2	3	4	5	5	6
5	2	3	4	4	5	6
6	2	3	4	4	5	5

$$f(d, h, k_1, k_2) := k_1 \cdot d + k_2 \cdot \frac{h}{d}$$

$$\text{Resid}(k_1, k_2) := \begin{cases} h1 \leftarrow (5 \ 10 \ 15 \ 20 \ 25 \ 30)^T \\ d1 \leftarrow (0.25 \ 0.5 \ 0.75 \ 1 \ 1.25 \ 1.5 \ 2 \ 2.5 \ 3 \ 3.5 \ 4 \ 5 \ 6)^T \\ \text{for } i \in 0.. \text{rows}(d1) - 1 \\ \quad \text{for } j \in 0.. \text{rows}(h1) - 1 \\ \quad \quad \delta_{i,j} \leftarrow f(d1_i, h1_j, k_1, k_2) - N_{i,j} \\ \delta \end{cases}$$

$$k_1 := 0.4 \quad k_2 := 0.57 \quad \text{Starting values}$$

Given

$$\text{Resid}(k_1, k_2) = 0$$

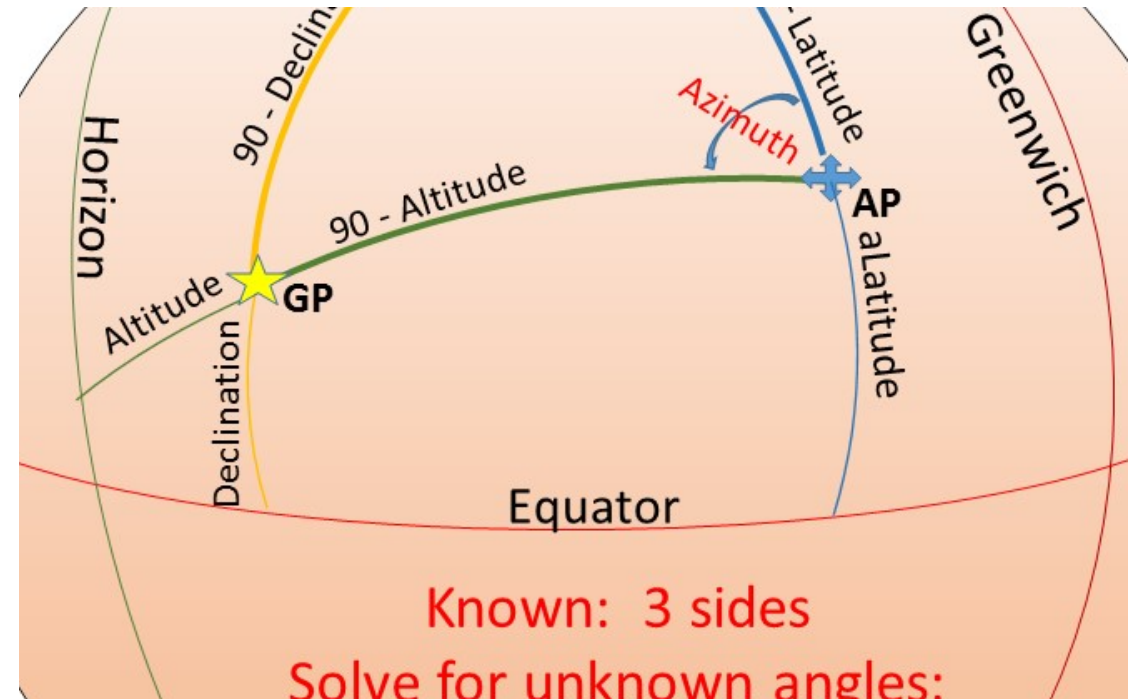
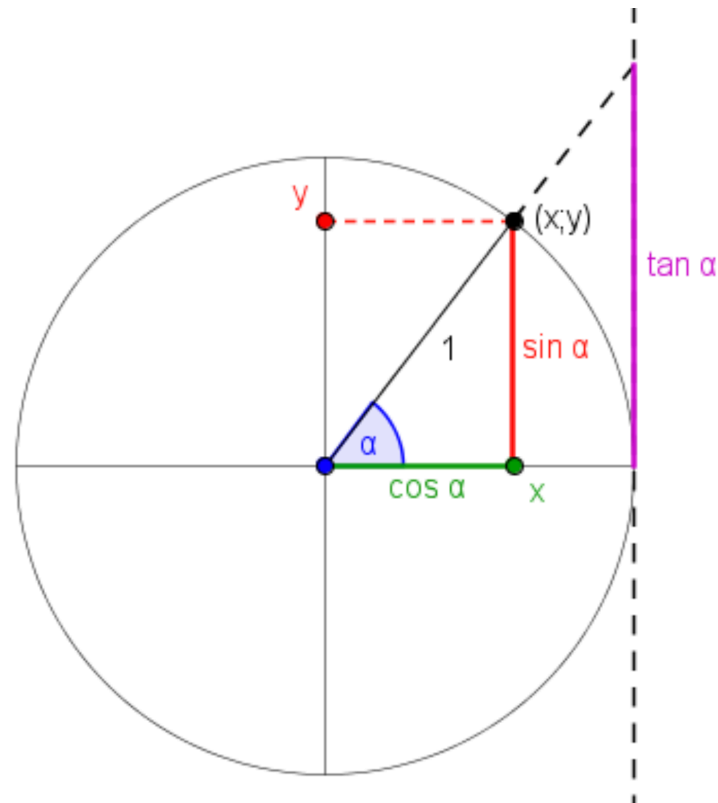
$$\begin{pmatrix} k_1 \end{pmatrix} = \text{Minerr}(k_1, k_2) = \begin{pmatrix} 0.39839030 \end{pmatrix}$$

As will be shown below, the curve fit results are similar to

Nautický trojúhelník

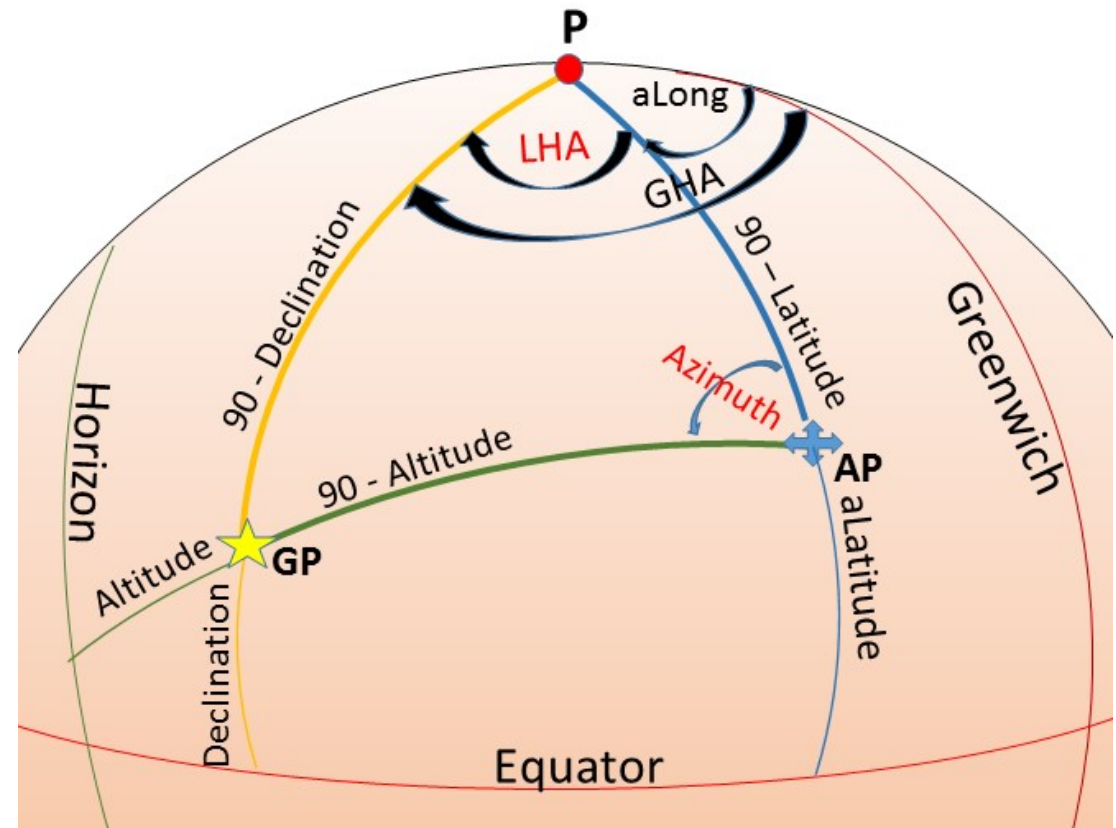
- $H_c = \sin^{-1}(\sin Dec \times \sin Lat + \cos Dec \times \cos Lat \times \cos LHA)$
- $Z = \cos^{-1}(\sin Dec \times \cos Lat + \cos Dec \times \sin Lat \times \cos LHA)$

- Zn (azimuth)
- N polokoule
 - $LHA > 180^\circ$ potom $Zn = Z$
 - $LHA < 180^\circ$ potom $Zn = 360^\circ - Z$
- S polokoule
 - $LHA > 180^\circ$ potom $Zn = 180^\circ - Z$
 - $LHA < 180^\circ$ potom $Zn = 180^\circ + Z$



Výpočet interceptu

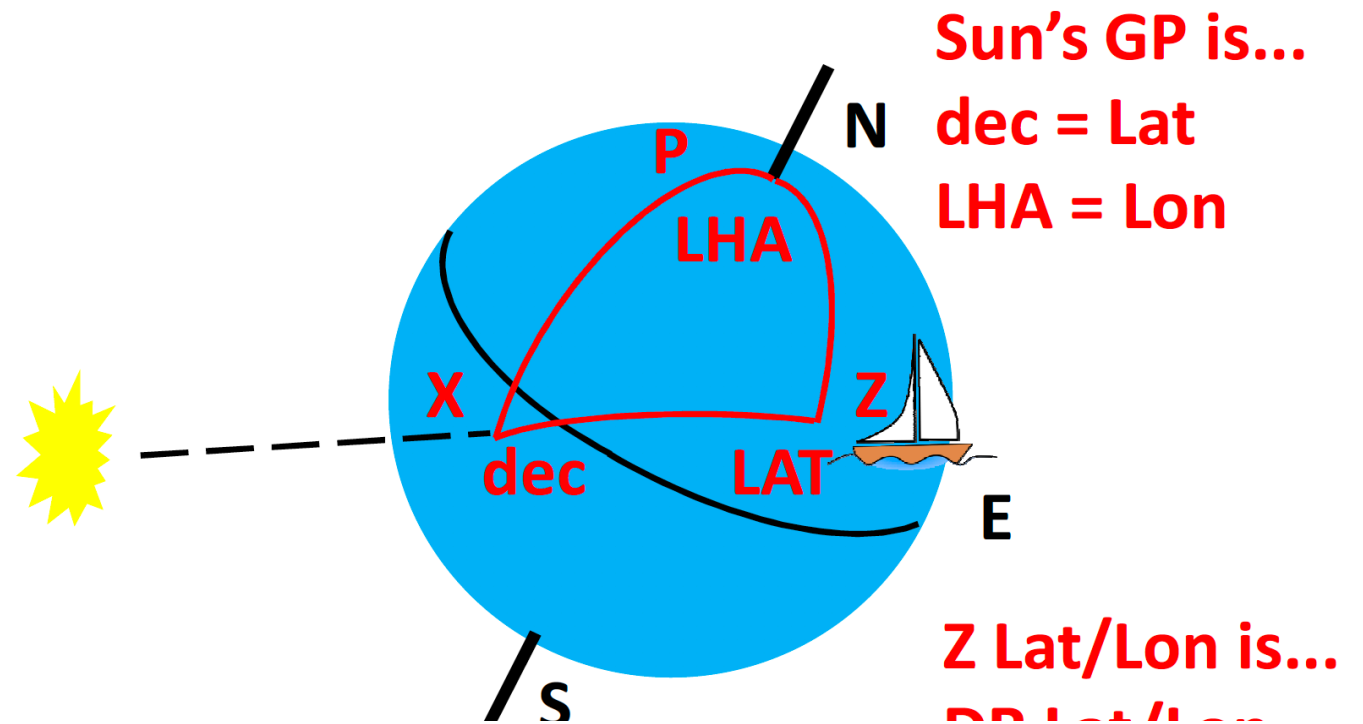
- H_c = kalkulovaná výška měření
 - Každé pozici (s celými stupni latitude) na zeměkouli odpovídá v daný čas určitá výška tělesa
- Z = hodnota, pomocí které určím Z_n (azimuth)
- $H_c = \sin^{-1}(\sin Dec \times \sin Lat + \cos Dec \times \cos Lat \times \cos LHA)$
- $Z = \cos^{-1}(\sin Dec \times \cos Lat + \cos Dec \times \sin Lat \times \cos LHA)$
- *N polokoule*
 - $LHA > 180^\circ$ potom $Z_n = Z$
 - $LHA < 180^\circ$ potom $Z_n = 360^\circ - Z$
- *S polokoule*
 - $LHA > 180^\circ$ potom $Z_n = 180^\circ - Z$
 - $LHA < 180^\circ$ potom $Z_n = 180^\circ + Z$



Matematika v astronavigaci

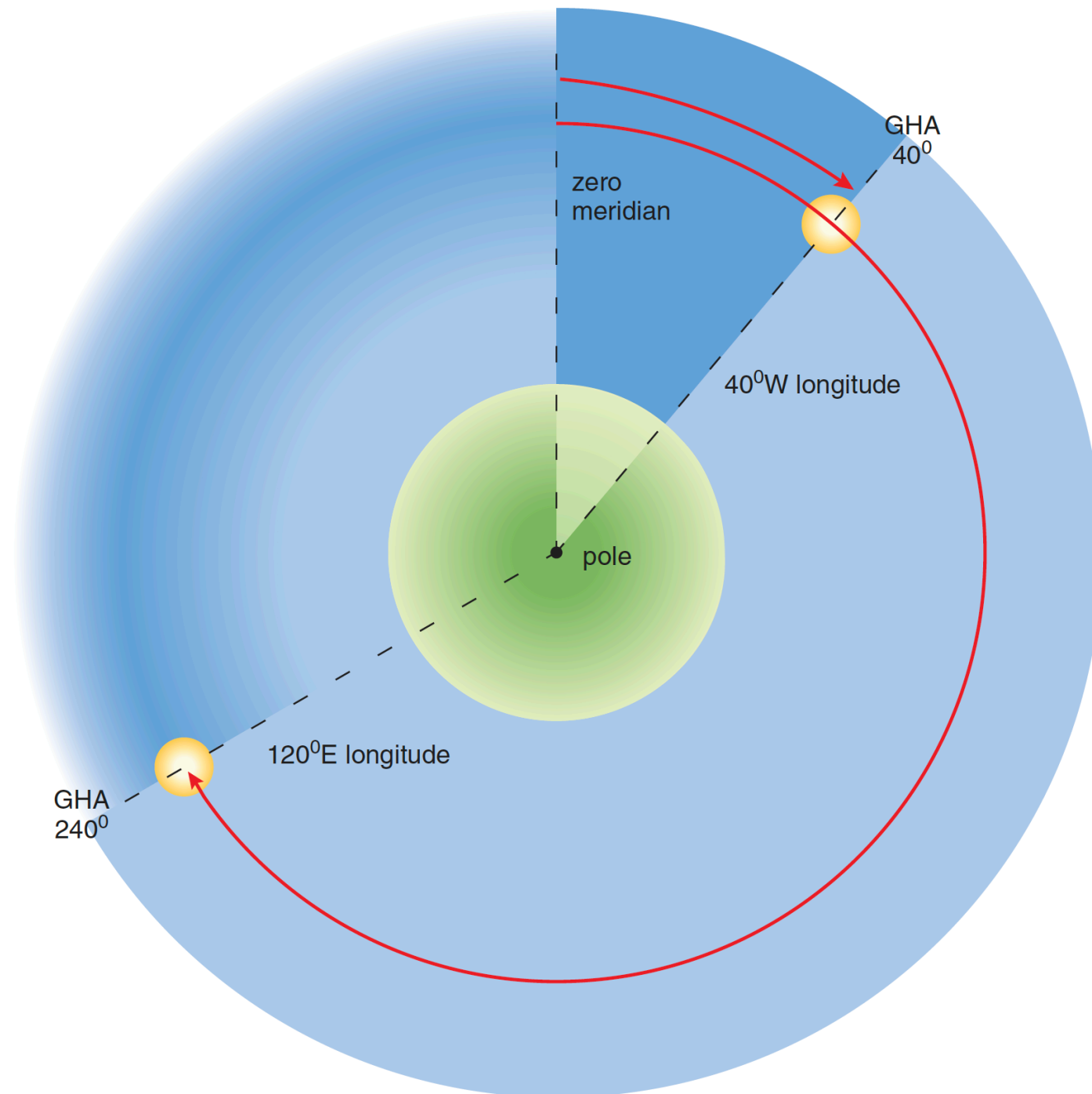
- Není třeba umět počítání logaritmických funkcí
- Vše už bylo spočítáno
- Pro astronavigaci stačí sčítání a odčítání
- POZOR
 - Počítání v 60tkové soustavě
 - Nejčastější chyba je ve sčítání a odčítání úhlů a minut
 - $90^\circ = 89^\circ 60'$
- Odpověď na vše dávají tabulky
 - Nautical Almanac
 - Sight Reduction Tables

The Navigational Triangle...



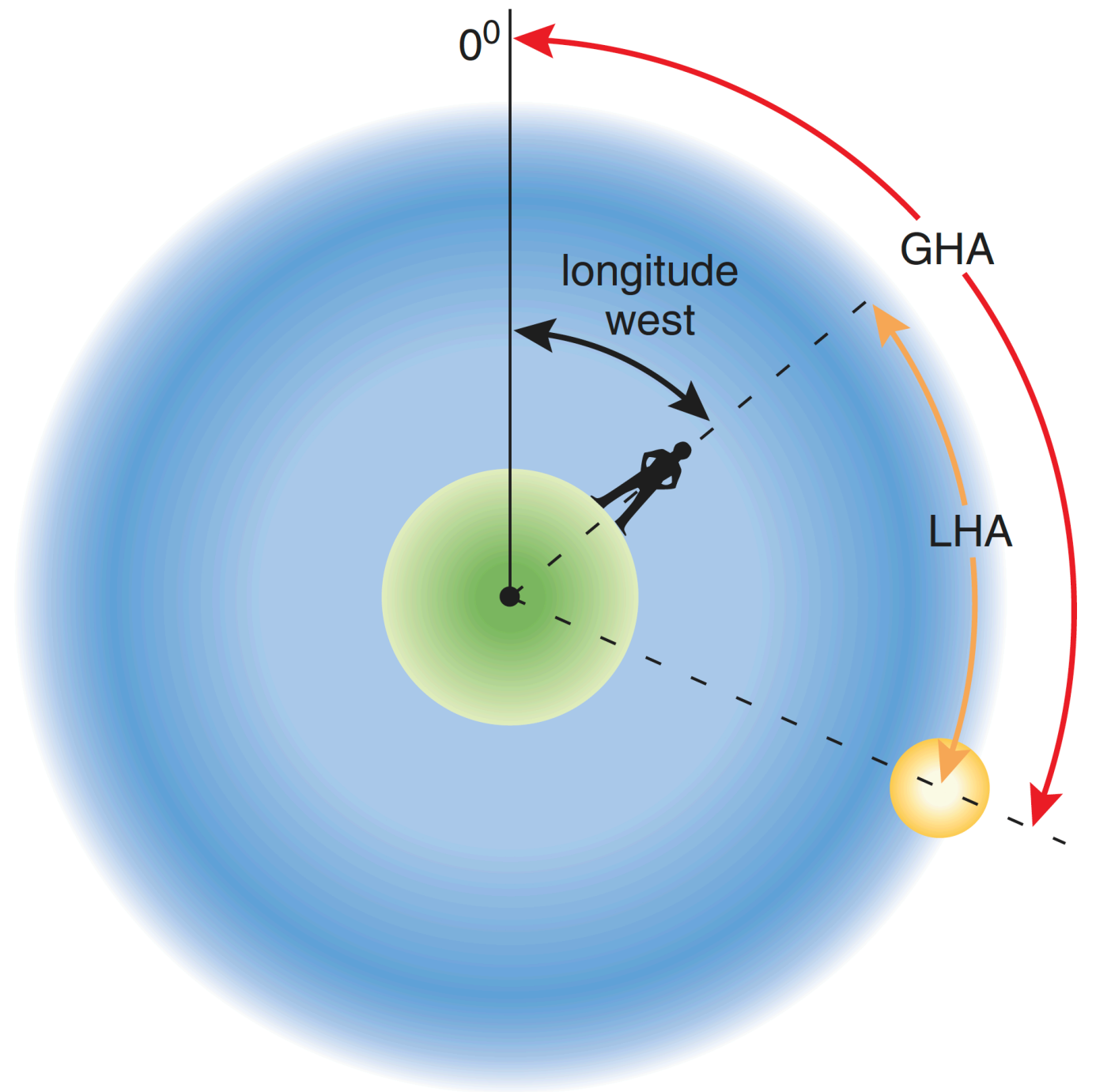
GHA – Greenwich Hour Angle

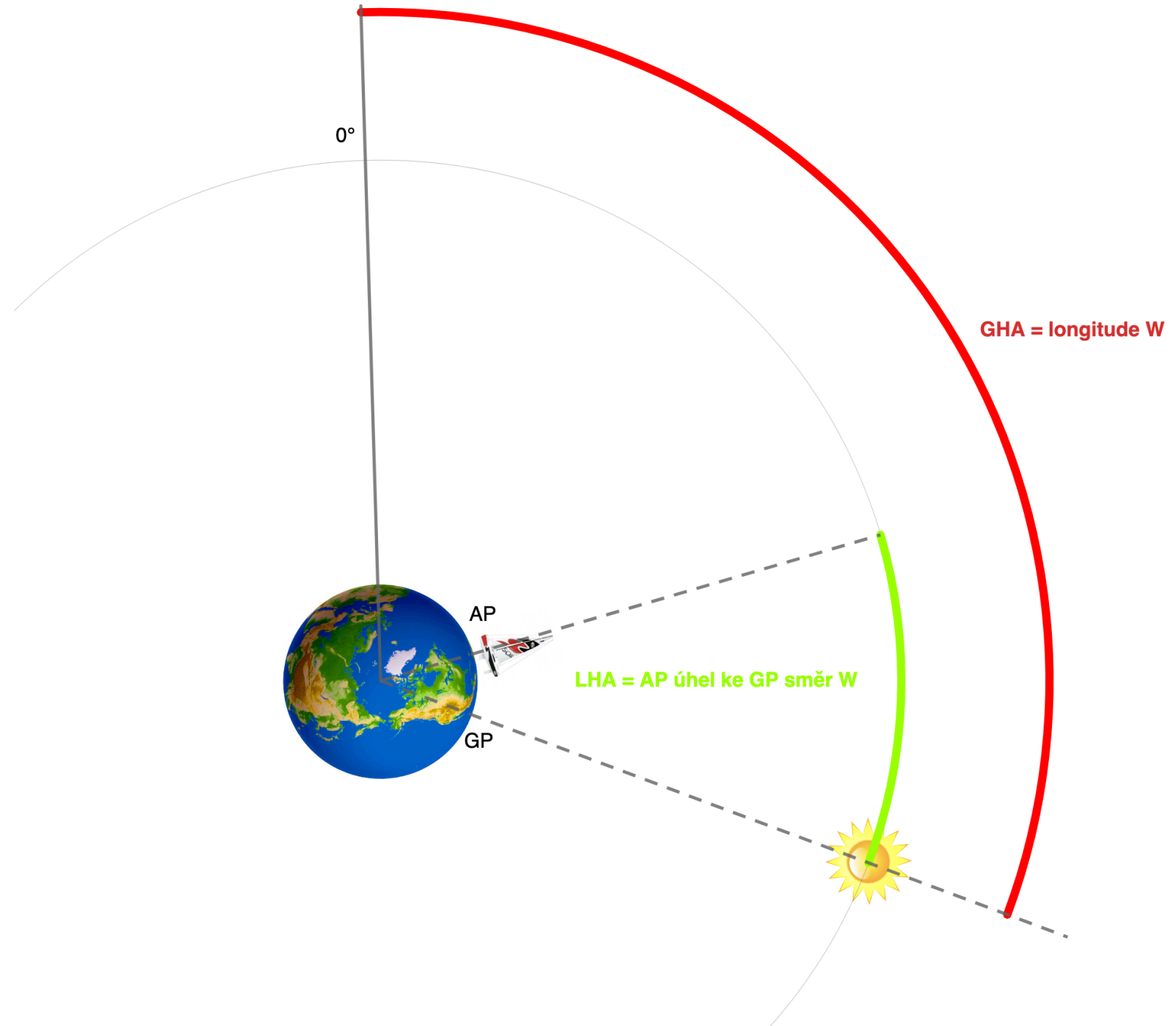
- Úhlová vzdálenost mezi Prime meridian a GP v určitý čas (UT)
- $GHA = \text{longitude GP W}$
- Pro výpočet platí:
 - Udává se směrem West
- Zjistím v Nautical Almanac
 - SUN
 - Moon
 - Stars & Planets



LHA – Local Hour Angle

- Úhlová vzdálenost mezi mojí pozicí (long.) a GP
- Pro výpočet platí:
 - Long W potom
 $LHA = GHA - \text{long.}$
 - Long E potom
 $LHA = GHA + \text{logn.}$





0°

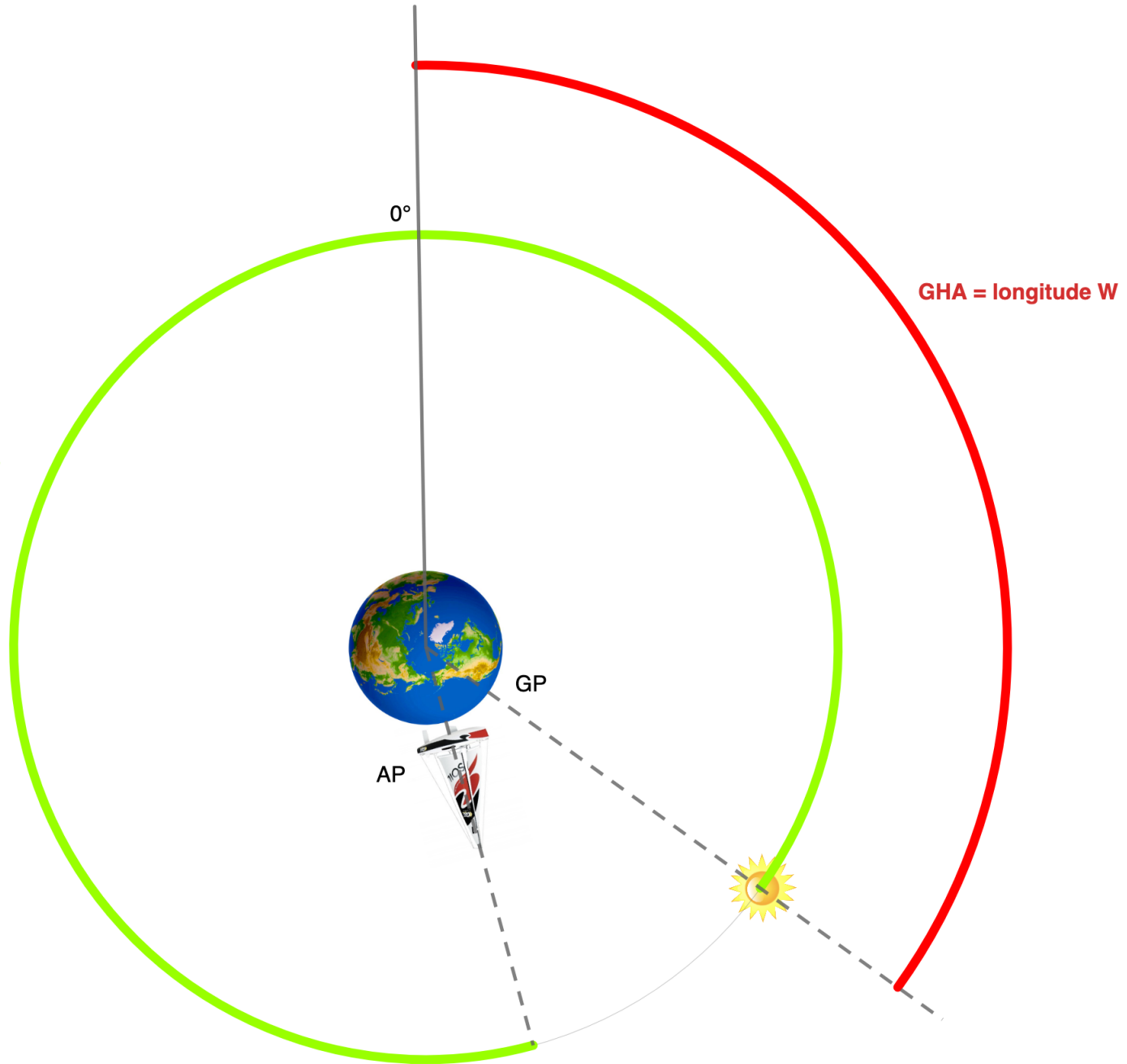
GHA = longitude W

LHA = AP úhel ke GP směř W

AP

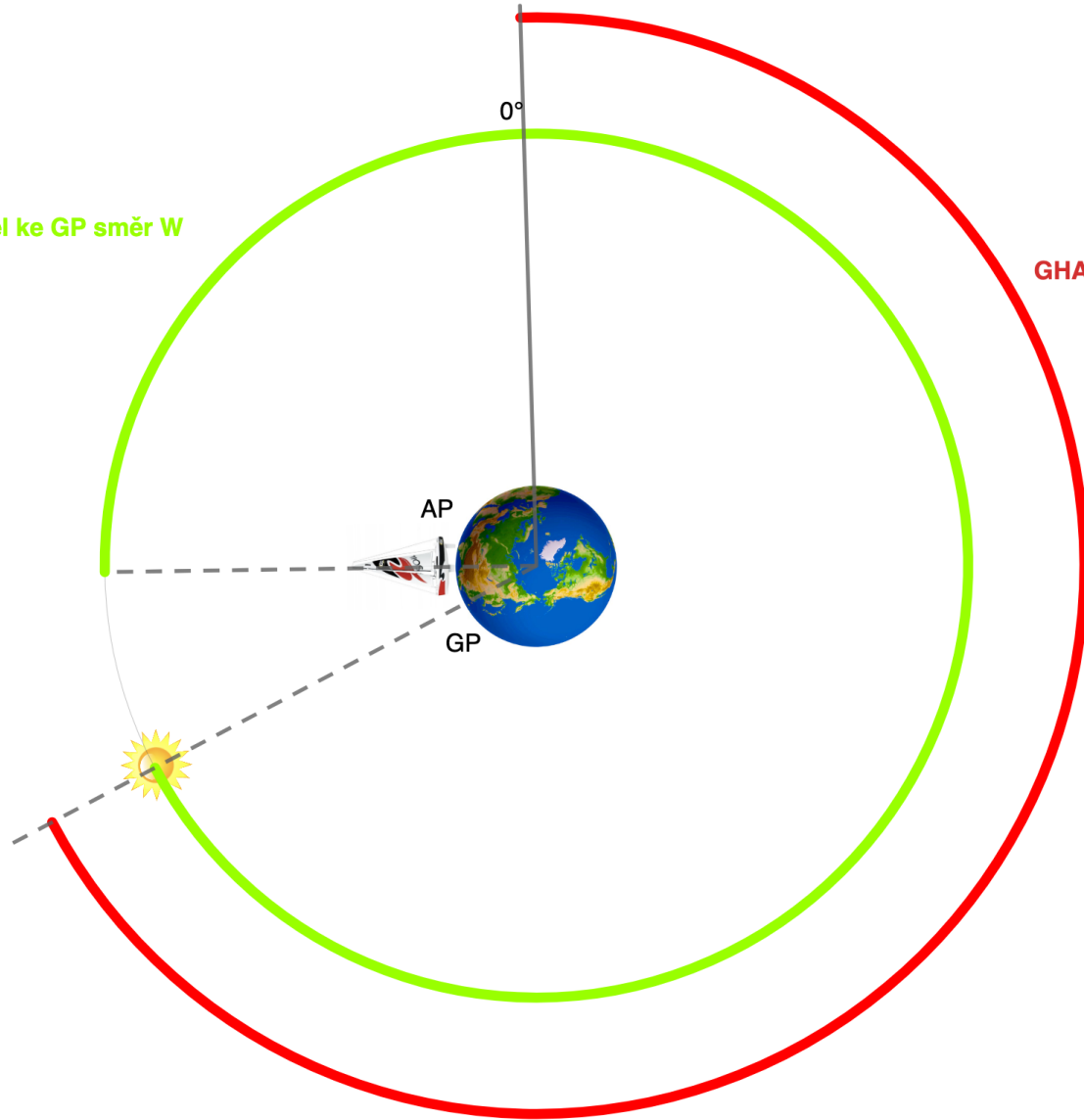
GP

LHA = AP úhel ke GP směr W

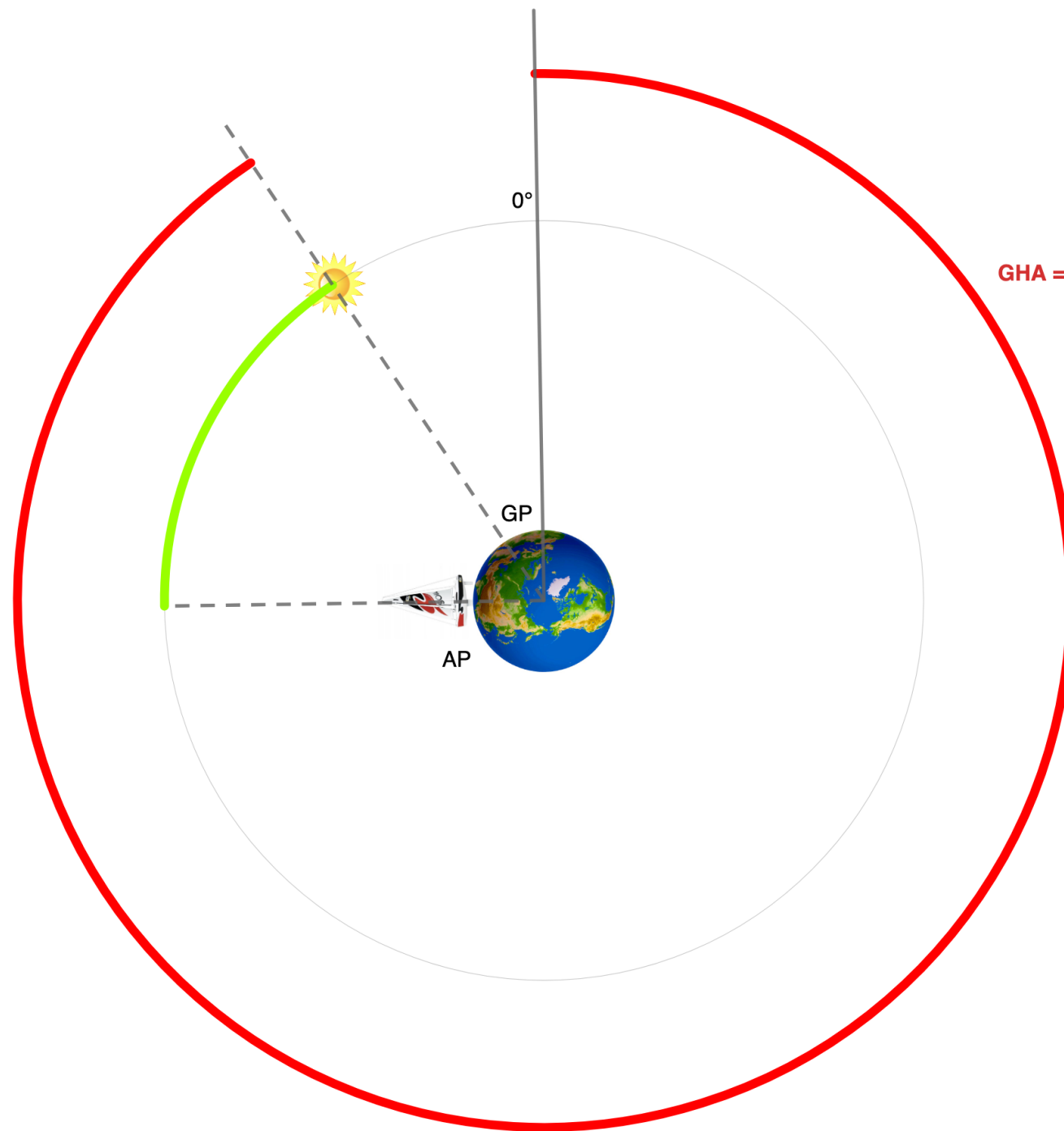


LHA = AP úhel ke GP směř W

GHA = longitude W



LHA = AP úhel ke GP směr W



GHA = longitude W

THE
NAUTICAL
ALMANAC

FOR THE YEAR
2021

WASHINGTON:
United States
Naval Observatory
2020

TAUNTON:
The United Kingdom
Hydrographic Office
2020

NSN 7642016861552
NGA Ref No. NAUTALMANA

SIGHT REDUCTION
TABLES
FOR
MARINE NAVIGATION
LATITUDES 30° - 45°, Inclusive

PUB. NO. 229
VOLUME 3

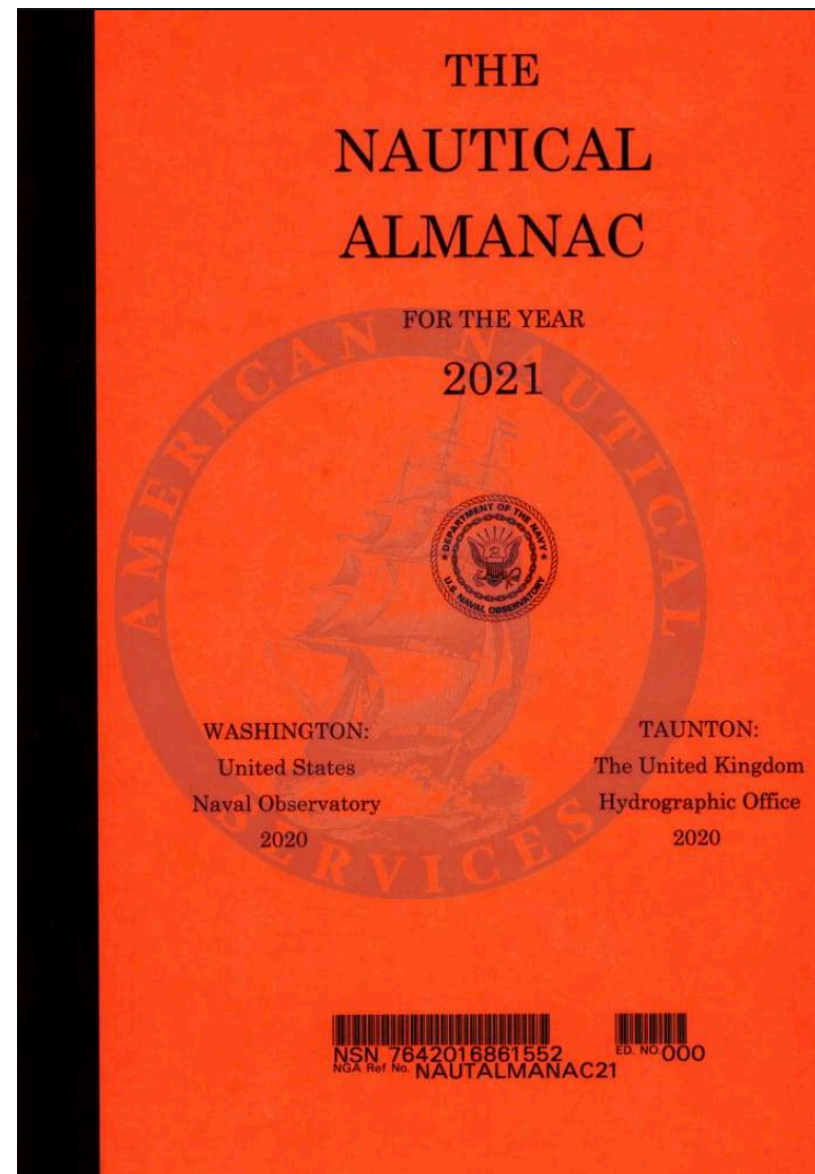


Nautical Almanac Sight Reduction Tables

Nautical Almanac 2021

Obsah

- Denní stránky pro rok 2021
- Pomocné stránky
 - Increments
 - Corrections
 - DIP



Daily page

Pro každý den v roce obsahuje následující údaje:

- GHA
- Dec
- d korekci

Údaje jsou pro celou hodinu v UT

- Pro úpravu na konkrétní čas potřebujeme Increments

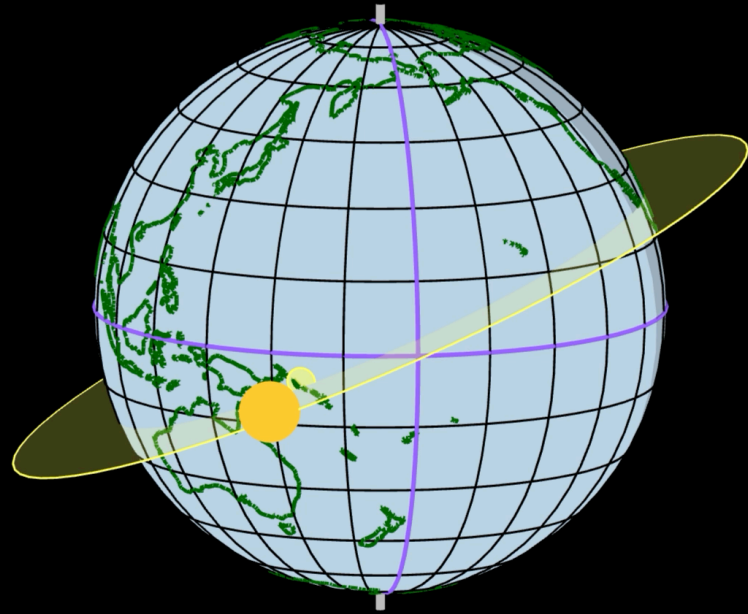
UT	SUN	
d h	GHA	Dec
12 00	176 26.9	S13 41.4
01	191 26.9	40.6
02	206 26.9	39.7
03	221 27.0	38.9
04	236 27.0	38.1
05	251 27.0	37.2
06	266 27.0	S13 36.4
07	281 27.0	35.6
08	296 27.0	34.7
09	311 27.0	33.9
10	326 27.0	33.1
11	341 27.0	32.2
12	356 27.0	S13 31.4
13	11 27.0	30.5
14	26 27.0	29.7
15	41 27.1	28.9
16	56 27.1	28.0
17	71 27.1	27.2
18	86 27.1	S13 26.4
19	101 27.1	25.5
20	116 27.1	24.7
21	131 27.1	23.8
22	146 27.1	23.0
23	161 27.2	22.2

S12 45.6
44.8
43.9
43.1
42.2
41.4

d 0.8

2021 FEBRUARY 12, 13, 14 (FRI., SAT., SUN.)

UT	SUN		MOON				Lat.	Twilight			Sunrise	Moonrise			
	GHA	Dec	GHA	v	Dec	d		Naut.	Civil	Naut.		12	13	14	15
12 00	176 26.9	S13 41.4	172 23.2	11.0	S 17	15.9	10.3	06 24	07 46	09 08	10 45	10 01	09 33	09 09	
01	191 26.9	40.6	186 53.2	11.0	17	05.6	10.4	06 19	07 25	08 28	10 11	09 44	09 24	09 07	
02	206 26.9	39.7	201 23.2	11.1	16	55.1	10.5	06 17	07 18	08 14	09 26	09 19	09 12	09 06	
03	221 27.0	38.9	215 53.3	11.2	16	44.6	10.6	06 15	07 11	08 03	09 16	09 09	09 07	09 05	
04	236 27.0	38.1	230 23.6	11.3	16	34.1	10.6	06 13	07 05	07 53	08 57	09 01	09 03	09 04	
05	251 27.0	37.2	244 53.9	11.4	16	23.4	10.7	06 11	07 00	07 45	08 46	08 53	08 59	09 04	
06	266 27.0	S13 36.4	259 24.3	11.5	S 16	12.7	10.8	06 10	06 56	07 37	08 36	08 47	08 56	09 03	
07	281 27.0	35.6	273 54.7	11.6	16	02.0	10.9	06 08	06 52	07 31	08 27	08 41	08 53	09 03	
08	296 27.0	34.7	288 25.3	11.7	15	51.1	10.9	06 06	06 48	07 25	08 20	08 36	08 50	09 03	
09	311 27.0	33.9	302 56.0	11.7	15	40.2	11.0	06 05	06 45	07 20	08 13	08 32	08 48	09 02	
10	326 27.0	33.1	317 26.7	11.8	15	29.2	11.1	06 03	06 41	07 15	08 06	08 28	08 46	09 02	
11	341 27.0	32.2	331 57.5	11.9	15	18.1	11.1	06 00	06 34	07 05	07 53	08 19	08 41	09 01	
12	356 27.0	S13 31.4	346 28.4	12.0	S 15	07.0	11.2	05 58	06 28	06 56	07 42	08 11	08 37	09 01	
13	11 27.0	30.5	0 59.4	12.1	14	55.8	11.2	05 53	06 23	06 49	07 32	08 04	08 33	09 00	
14	26 27.0	29.7	15 30.5	12.2	14	44.6	11.3	05 50	06 18	06 42	07 24	07 58	08 30	09 00	
15	41 27.1	28.9	30 01.6	12.2	14	33.3	11.4	05 42	06 08	06 31	07 09	07 49	08 25	08 59	
16	56 27.1	28.0	44 32.9	12.3	14	21.9	11.4	05 34	05 59	06 20	06 56	07 40	08 20	08 58	
17	71 27.1	27.2	59 04.2	12.4	14	10.5	11.5	05 25	05 50	06 11	06 44	07 31	08 16	08 58	
18	86 27.1	S13 26.4	73 35.6	12.5	S 13	59.0	11.5	05 14	05 39	06 01	06 32	07 23	08 11	08 57	
19	101 27.1	25.5	88 07.0	12.6	13	47.5	11.6	05 01	05 28	05 51	06 19	07 14	08 06	08 56	
20	116 27.1	24.7	102 38.6	12.6	13	35.9	11.6	04 44	05 13	05 39	06 05	07 04	08 01	08 56	
21	131 27.1	23.8	117 10.2	12.7	13	24.3	11.7	04 33	05 05	05 31	05 56	06 58	07 58	08 55	
22	146 27.1	23.0	131 41.9	12.8	13	12.6	11.7	04 20	04 55	05 23	05 46	06 51	07 54	08 55	
23	161 27.2	22.2	146 13.7	12.9	13	00.8	11.8	04 03	04 42	05 14	05 34	06 43	07 50	08 54	
13 00	176 27.2	S13 21.3	160 45.6	12.9	S 12	49.0	11.8	03 42	04 27	05 02	05 20	06 34	07 45	08 54	
01	191 27.2	20.5	175 17.5	13.0	12	37.2	11.9	03 31	04 19	04 57	05 14	06 29	07 43	08 53	
02	206 27.2	19.6	189 49.5	13.1	12	25.3	11.9	03 19	04 11	04 51	05 06	06 24	07 40	08 53	
03	221 27.2	18.8	204 21.6	13.2	12	13.3	12.0	03 04	04 02	04 45	04 58	06 19	07 37	08 53	
04	236 27.2	17.9	218 53.8	13.2	12	01.4	12.0	02 47	03 51	04 37	04 49	06 13	07 34	08 52	
05	251 27.2	17.1	233 26.0	13.3	11	49.3	12.1	02 25	03 38	04 29	04 38	06 06	07 31	08 52	
06	266 27.3	S13 16.3	247 58.3	13.4	S 11	37.3	12.1	02 06	03 28	04 19	04 26	06 06	07 31	08 52	
07	281 27.3	15.4	262 30.7	13.4	11	25.1	12.2	01 53	03 15	04 06	04 12	05 59	07 30	08 51	
08	296 27.3	14.6	277 03.1	13.5	11	13.0	12.2	01 39	03 01	03 52	04 00	05 50	07 29	08 50	
09	311 27.3	13.7	291 35.6	13.5	11	00.8	12.2	01 24	02 48	03 39	03 55	05 48	07 28	08 49	
10	326 27.3	12.9	306 08.2	13.6	10	48.6	12.3	01 08	02 36	03 27	03 53	05 47	07 27	08 48	
11	341 27.3	12.0	320 40.8	13.7	10	36.3	12.3	00 53	02 25	03 16	03 42	05 46	07 26	08 47	
12	356 27.4	S13 11.2	335 13.6	13.8	S 10	24.0	12.3	00 37	02 14	03 05	03 31	05 45	07 25	08 46	
13	11 27.4	10.3	349 46.3	13.8	10	11.7	12.4	00 21	02 03	02 54	03 20	05 44	07 24	08 45	
14	26 27.4	09.5	4 19.2	13.9	9	59.3	12.4	00 05	01 52	02 43	03 19	05 43	07 23	08 44	
15	41 27.4	08.6	18 52.1	14.0	9	46.9	12.4	00 00	01 41	02 32	03 08	05 42	07 22	08 43	
16	56 27.4	07.8	33 25.1	14.0	9	34.5	12.5	00 00	01 30	02 21	03 00	05 41	07 21	08 42	
17	71 27.4	07.0	47 58.1	14.1	9	22.0	12.5	00 00	01 20	02 10	02 50	05 40	07 20	08 41	
18	86 27.5	S13 06.1	62 31.2	14.2	S 9	09.5	12.5	00 00	01 10	02 00	02 40	05 39	07 19	08 40	
19	101 27.5	05.3	77 04.4	14.2	8	57.0	12.6	00 00	01 00	01 50	02 30	05 38	07 18	08 39	
20	116 27.5	04.4	91 37.6	14.3	8	44.4	12.6	00 00	00 50	01 40	02 20	05 37	07 17	08 38	
21	131 27.5	03.6	106 10.9	14.3	8	31.8	12.6	00 00	00 40	01 30	02 10	05 36	07 16	08 37	
22	146 27.5	02.7	120 44.2	14.4	8	19.2	12.6	00 00	00 30	01 20	02 00	05 35	07 15	08 36	
23	161 27.6	01.9	135 17.6	14.5	8	06.6	12.7	00 00	00 20	01 10	01 50	05 34	07 14	08 35	
14 00	176 27.6	S13 01.0	149 51.0	14.5	S 7	53.9	12.7	00 00	00 10	01 00	01 40	05 33	07 13	08 34	
01	191 27.6	13 00.2	164 24.5	14.6	7	41.3	12.7	00 00	00 00	00 50	01 30	05 32	07 12	08 33	
02	206 27.6	12 59.3	178 58.1	14.6	7	28.6	12.7	00 00	00 00	00 40	01 20	05 31	07 11	08 32	
03	221 27.7	57.9	193 31.7	14.7	7	15.9	12.7	00 00	00 00	00 30	01 10	05 30	07 10	08 31	
04	236 27.7	57.0	208 05.4	14.7	7	03.3	12.8	00 00	00 00	00 20	01 00	05 29	07 09	08 30	
05	251 27.7	56.8	222 39.1	14.8	6	50.4	12.8	00 00	00 00	00 10	00 50	05 28	07 08	08 29	
06	266 27.7	S12 55.9	237 12.9	14.8	S 6	37.6	12.8	00 00	00 00	00 00	00 40	05 27	07 07	08 28	
07	281 27.7	55.0	251 46.7	14.9	6	24.8	12.8	00 00	00 00	00 00	00 30	05 26	07 06	08 27	
08	296 27.8	54.2	266 20.5	14.9	6	12.0	12.8	00 00	00 00	00 00	00 20	05 25	07 05	08 26	
09	311 27.8	53.3	280 54.5	15.0	5	59.2	12.8	00 00	00 00	00 00	00 10	05 24	07 04	08 25	
10	326 27.8	52.5	295 28.4	15.0	5	46.4	12.8	00 00	00 00	00 00	00 00	05 23	07 03	08 24	
11	341 27.8	51.6	310 02.4	15.1	5	33.5	12.9	00 00	00 00	00 00	00 00	05 22	07 02	08 23	
12	356 27.9	S12 50.8	324 36.5	15.1	S 5	20.7	12.9	00 00	00 00	00 00	00 00	05 21	07 01	08 22	
13	11 27.9	49.9	339 10.6	15.1	5	07.8	12.9	00 00	00 00	00 00	00 00	05 20	07 00	08 21	
14	26 27.9	49.1	353 44.7	15.2	4	54.9	12.9	00 00	00 00	00 00	00 00	05 19	06 59	08 20	
15	41 27.9	48.2	8 18.9	15.2	4	42.0	12.9	00 00	00 00	00 00	00 00	05 18	06 58	08 19	
16	56 28.0	47.4	22 53.1	15.3	4	29.1	12.9	00 00	00 00	00 00	00 00	05 17	06 57	08 18	
17	71 28.0	46.5	37 27.4	15.3	4	16.2	12.9	00 00	00 00	00 00	00 00	05 16	06 56	08 17	
18	86 28.0	S12 45.6	52 01.7	15.3	S 4	03.3	12.9	00 00	00 00	00 00	00 00	05 15	06 55	08 16	
19	101 28.1	44.8	66 36.1	15.4	3	50.4	12.9	00 00	00 00	00 00	00 00	05 14	06 54	08 15	
20	116 28.1	43.9	81 10.4	15.4	3	37.5	12.9	00 00	00 00	00 00	00 00	05 13	06 53	08 14	
21	131 28.1	43.1	95 44.9	15.5	3	24.5	12.9	00 00	00 00	00 00	00 00	05 12	06 52	08 13	
22	146 28.1	42.2	110 19.3	15											



Increments

Úprava GHA a Dec s přesností na minuty a vteřiny

Příklad:
Lokální čas: 12:00:34 LT
Čas měření: 00:00:34 UT

GHA a Dec pro 00:00:00

UT	SUN	
d h	GHA	Dec
o ' "	o ' "	o ' "
12 00	176 26.9	S13 41.4
01	101 26.0	40.6

S12 45.6
44.8
43.9
43.1
42.2
41.4

d 0.8

GHA	176°26,9'
Incr (m/s)	0°08,5'
GHA	176°35,4'
DEC (NA) N / S	13°41,4'
d + - (-0,8)	0,0'
DEC N / S	13°41,4'

30	0 07.5
31	0 07.8
32	0 08.0
33	0 08.2
34	0 08.5

v or Corr ⁿ	d
0.0	0.0
0.1	0.0
0.2	0.0
0.3	0.0
0.4	0.0
0.5	0.0
0.6	0.0
0.7	0.0
0.8	0.0
0.9	0.0

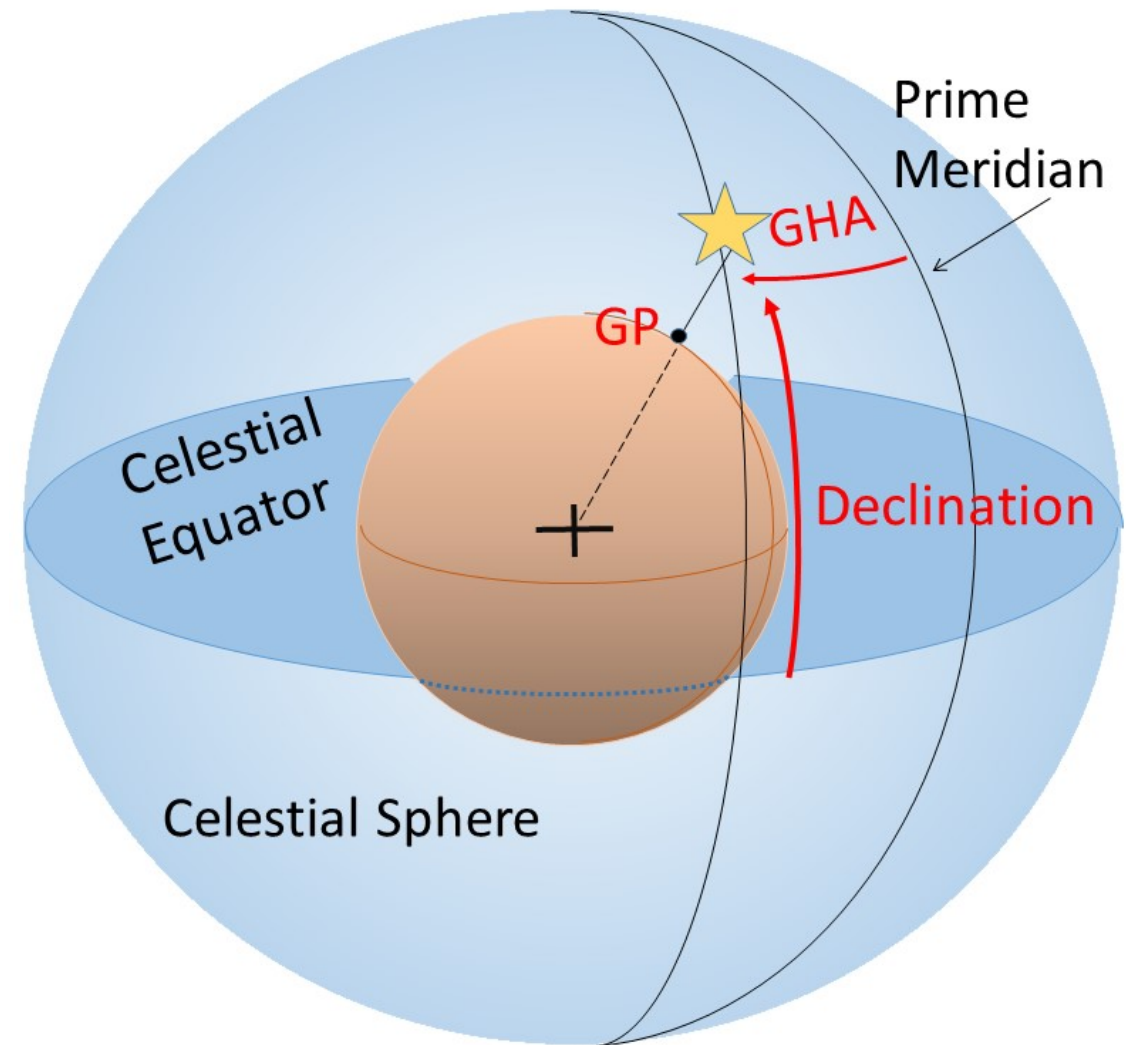
0 ^m										INCREMENTS AND CORRECTIONS										1 ^m									
m	SUN	ARIES	MOON	v or Corr ⁿ	d	v or Corr ⁿ	d	v or Corr ⁿ	d	m	SUN	ARIES	MOON	v or Corr ⁿ	d	v or Corr ⁿ	d	v or Corr ⁿ	d	m	SUN	ARIES	MOON	v or Corr ⁿ	d	v or Corr ⁿ	d	v or Corr ⁿ	d
00	0 00.0	0 00.0	0 00.0	0.0	0.0	6.0	0.1	12.0	0.1	00	0 15.0	0 15.0	0 14.3	0.0	0.0	6.0	0.2	12.0	0.3	00	0 15.0	0 15.0	0 14.3	0.0	0.0	6.0	0.2	12.0	0.3
01	0 00.2	0 00.3	0 00.2	0.1	0.0	6.1	0.1	12.1	0.1	01	0 15.2	0 15.3	0 14.6	0.1	0.0	6.1	0.2	12.1	0.3	01	0 15.2	0 15.3	0 14.6	0.1	0.0	6.1	0.2	12.1	0.3
02	0 00.5	0 00.5	0 00.5	0.2	0.0	6.2	0.1	12.2	0.1	02	0 15.5	0 15.5	0 14.8	0.2	0.0	6.2	0.2	12.2	0.3	02	0 15.5	0 15.5	0 14.8	0.2	0.0	6.2	0.2	12.2	0.3
03	0 00.8	0 00.8	0 00.7	0.3	0.0	6.3	0.1	12.3	0.1	03	0 15.8	0 15.8	0 15.0	0.3	0.0	6.3	0.2	12.3	0.3	03	0 15.8	0 15.8	0 15.0	0.3	0.0	6.3	0.2	12.3	0.3
04	0 01.0	0 01.0	0 01.0	0.4	0.0	6.4	0.1	12.4	0.1	04	0 16.0	0 16.0	0 15.3	0.4	0.0	6.4	0.2	12.4	0.3	04	0 16.0	0 16.0	0 15.3	0.4	0.0	6.4	0.2	12.4	0.3
05	0 01.2	0 01.3	0 01.2	0.5	0.0	6.5	0.1	12.5	0.1	05	0 16.2	0 16.3	0 15.5	0.5	0.0	6.5	0.2	12.5	0.3	05	0 16.2	0 16.3	0 15.5	0.5	0.0	6.5	0.2	12.5	0.3
06	0 01.5	0 01.5	0 01.4	0.6	0.0	6.6	0.1	12.6	0.1	06	0 16.5	0 16.5	0 15.7	0.6	0.0	6.6	0.2	12.6	0.3	06	0 16.5	0 16.5	0 15.7	0.6	0.0	6.6	0.2	12.6	0.3
07	0 01.8	0 01.8	0 01.7	0.7	0.0	6.7	0.1	12.7	0.1	07	0 16.8	0 16.8	0 16.0	0.7	0.0	6.7	0.2	12.7	0.3	07	0 16.8	0 16.8	0 16.0	0.7	0.0	6.7	0.2	12.7	0.3
08	0 02.0	0 02.0	0 01.9	0.8	0.0	6.8	0.1	12.8	0.1	08	0 17.0	0 17.0	0 16.2	0.8	0.0	6.8	0.2	12.8	0.3	08	0 17.0	0 17.0	0 16.2	0.8	0.0	6.8	0.2	12.8	0.3
09	0 02.2	0 02.3	0 02.1	0.9	0.0	6.9	0.1	12.9	0.1	09	0 17.2	0 17.3	0 16.5	0.9	0.0	6.9	0.2	12.9	0.3	09	0 17.2	0 17.3	0 16.5	0.9	0.0	6.9	0.2	12.9	0.3
10	0 02.5	0 02.5	0 02.4	1.0	0.0	7.0	0.1	13.0	0.1	10	0 17.5	0 17.5	0 16.7	1.0	0.0	7.0	0.2	13.0	0.3	10	0 17.5	0 17.5	0 16.7	1.0	0.0	7.0	0.2	13.0	0.3
11	0 02.8	0 02.8	0 02.6	1.1	0.0	7.1	0.1	13.1	0.1	11	0 17.8	0 17.8	0 16.9	1.1	0.0	7.1	0.2	13.1	0.3	11	0 17.8	0 17.8	0 16.9	1.1	0.0	7.1	0.2	13.1	0.3
12	0 03.0	0 03.0	0 02.9	1.2	0.0	7.2	0.1	13.2	0.1	12	0 18.0	0 18.0	0 17.2	1.2	0.0	7.2	0.2	13.2	0.3	12	0 18.0	0 18.0	0 17.2	1.2	0.0	7.2	0.2	13.2	0.3
13	0 03.2	0 03.3	0 03.1	1.3	0.0	7.3	0.1	13.3	0.1	13	0 18.2	0 18.3	0 17.4	1.3	0.0	7.3	0.2	13.3	0.3	13	0 18.2	0 18.3	0 17.4	1.3	0.0	7.3	0.2	13.3	0.3
14	0 03.5	0 03.5	0 03.3	1.4	0.0	7.4	0.1	13.4	0.1	14	0 18.5	0 18.6	0 17.7	1.4	0.0	7.4	0.2	13.4	0.3	14	0 18.5	0 18.6	0 17.7	1.4	0.0	7.4	0.2	13.4	0.3
15	0 03.8	0 03.8	0 03.6	1.5	0.0	7.5	0.1	13.5	0.1	15	0 18.8	0 18.8	0 17.9	1.5	0.0	7.5	0.2	13.5	0.3	15	0 18.8	0 18.8	0 17.9	1.5	0.0	7.5	0.2	13.5	0.3
16	0 04.0	0 04.0	0 03.8	1.6	0.0	7.6	0.1	13.6	0.1	16	0 19.0	0 19.1	0 18.1	1.6	0.0	7.6	0.2	13.6	0.3	16	0 19.0	0 19.1	0 18.1	1.6	0.0	7.6	0.2	13.6	0.3
17	0 04.2	0 04.3	0 04.1	1.7	0.0	7.7	0.1	13.7	0.1	17	0 19.2	0 19.3	0 18.4	1.7	0.0	7.7	0.2	13.7	0.3	17	0 19.2	0 19.3	0 18.4	1.7	0.0	7.7	0.2	13.7	0.3
18	0 04.5	0 04.5	0 04.3	1.8	0.0	7.8	0.1	13.8	0.1	18	0 19.5	0 19.6	0 18.6	1.8	0.0	7.8	0.2	13.8	0.3	18	0 19.5	0 19.6	0 18.6	1.8	0.0	7.8	0.2	13.8	0.3
19	0 04.8	0 04.8	0 04.5	1.9	0.0	7.9	0.1	13.9	0.1	19	0 19.8	0 19.8	0 18.9	1.9	0.0	7.9	0.2	13.9	0.3	19	0 19.8	0 19.8	0 18.9	1.9	0.0	7.9	0.2	13.9	0.3
20	0 05.0	0 05.0	0 04.8	2.0	0.0	8.0	0.1	14.0	0.1	20	0 20.0	0 20.1	0 19.1	2.0	0.1	8.0	0.2	14.0	0.4	20	0 20.0	0 20.1	0 19.1	2.0	0.1	8.0	0.2	14.0	0.4
21	0 05.2	0 05.3	0 05.0	2.1	0.0	8.1	0.1	14.1	0.1	21	0 20.2	0 20.3	0 19.3	2.1	0.1	8.1	0.2	14.1	0.4	21	0 20.2	0 20.3	0 19.3	2.1	0.1	8.1	0.2	14.1	0.4
22	0 05.5	0 05.5	0 05.2	2.2	0.0	8.2	0.1	14.2	0.1	22	0 20.5	0 20.6	0 19.6	2.2	0.1	8.2	0.2	14.2	0.4	22	0 20.5	0 20.6	0 19.6	2.2	0.1	8.2	0.2	14.2	0.4
23	0 05.8	0 05.8	0 05.5	2.3	0.0	8.3	0.1	14.3	0.1	23	0 20.8	0 20.8	0 19.8	2.3	0.1	8.3	0.2	14.3	0.4	23	0 20.8	0 20.8	0 19.8	2.3	0.1	8.3	0.2	14.3	0.4
24	0 06.0	0 06.0	0 05.7	2.4	0.0	8.4	0.1	14.4	0.1	24	0 21.0	0 21.1	0 20.0	2.4	0.1	8.4	0.2	14.4	0.4	24	0 21.0	0 21.1	0 20.0	2.4	0.1	8.4	0.2	14.4	0.4
25	0 06.2	0 06.3	0 06.0	2.5	0.0	8.5	0.1	14.5	0.1	25	0 21.2	0 21.3	0 20.3	2.5	0.1	8.5	0.2	14.5	0.4	25	0 21.2	0 21.3	0 20.3	2.5	0.1	8.5	0.2	14.5	0.4
26	0 06.5	0 06.5	0 06.2	2.6	0.0	8.6	0.1	14.6	0.1	26	0 21.5	0 21.5	0 20.5	2.6	0.1	8.6	0.2	14.6	0.4	26	0 21.5	0 21.5	0 20.5	2.6	0.1	8.6	0.2	14.6	0.4
27	0 06.8	0 06.8	0 06.4	2.7	0.0	8.7	0.1	14.7	0.1	27	0 21.8	0 21.8	0 20.8	2.7	0.1	8.7	0.2	14.7	0.4	27	0 21.8	0 21.8	0 20.8	2.7	0.1	8.7	0.2	14.7	0.4
28	0 07.0	0 07.0	0 06.7	2.8	0.0	8.8	0.1	14.8	0.1	28	0 22.0	0 22.1	0 21.0	2.8	0.1	8.8	0.2	14.8	0.4	28	0 22.0	0 22.1	0 21.0	2.8	0.1	8.8	0.2	14.8	0.4
29	0 07.2	0 07.3	0 06.9	2.9	0.0	8.9	0.1	14.9	0.1	29	0 22.2	0 22.3	0 21.2	2.9	0.1	8.9	0.2	14.9	0.4	29	0 22.2	0 22.3	0 21.2	2.9	0.1	8.9	0.2	14.9	0.4
30	0 07.5	0 07.5	0 07.2	3.0	0.0	9.0	0.1	15.0	0.1	30	0 22.5	0 22.6	0 21.5	3.0	0.1	9.0	0.2	15.0	0.4	30	0 22.5	0 22.6	0 21.5	3.0	0.1	9.0	0.2	15.0	0.4
31	0 07.8	0 07.8	0 07.4	3.1	0.0	9.1	0.1	15.1	0.1	31	0 22.8	0 22.8	0 21.7	3.1	0.1	9.1	0.2	15.1	0.4	31	0 22.8	0 22.8	0 21.7	3.1	0.1	9.1	0.2	15.1	0.4
32	0 08.0	0 08.0	0 07.6	3.2	0.0	9.2	0.1	15.2	0.1	32	0 23.0	0 23.1	0 22.0	3.2	0.1	9.2	0.2	15.2	0.4	32	0 23.0	0 23.1	0 22.0	3.2	0.1	9.2	0.2	15.2	0.4
33	0 08.2	0 08.3	0 07.9	3.3	0.0	9.3	0.1	15.3	0.1	33	0 23.2	0 23.3	0 22.2	3.3	0.1	9.3	0.2	15.3	0.4	33	0 23.2	0 23.3	0 22.2	3.3	0.1	9.3	0.2	15.3	0.4
34	0 08.5	0 08.5	0 08.1	3.4	0.0	9.4	0.1	15.4	0.1	34	0 23.5	0 23.6	0 22.4	3.4	0.1	9.4	0.2	15.4	0.4	34	0 23.5	0 23.6	0 22.4	3.4	0.1	9.4	0.2	15.4	0.4
35	0 08.8	0 08.8	0 08.4	3.5	0.0	9.5	0.1	15.5	0.1	35	0 23.8	0 23.8	0 22.7	3.5	0.1	9.5	0.2	15.5	0.4	35	0 23.8	0 23.8	0 22.7	3.5	0.1	9.5	0.2	15.5	0.4
36	0 09.0	0 09.0	0 08.6	3.6	0.0	9.6	0.1	15.6	0.1	36	0 24.0	0 24.1	0 22.9	3.6	0.1	9.6	0.2	15.6	0.4	36	0 24.0	0 24.1	0 22.9	3.6	0.1	9.6	0.2	15.6	0.4
37	0 09.2	0 09.3	0 08.8	3.7	0.0	9.7	0.1	15.7	0.1	37	0 24.2	0 24.3	0 23.1	3.7	0.1	9.7	0.2	15.7	0.4	37	0 24.2	0 24.3	0 23.1	3.7	0.1	9.7	0.2	15.7	0.4
38	0 09.5	0 09.5	0 09.1	3.8	0.0	9.8	0.1	15.8	0.1	38	0 24.5	0 24.6	0 23.4	3.8	0.1	9.8	0.2	15.8	0.4	38	0 24.5	0 24.6	0 23.4	3.8	0.1	9.8	0.2	15.8	0.4
39	0 09.8	0 09.8	0 09.3	3.9	0.0	9.9	0.1	15.9	0.1	39	0 24.8	0 24.8	0 23.6	3.9	0.1	9.9	0.2	15.9	0.4	39	0 24.8	0 24.8	0 23.6	3.					

Výsledek

Pomocí Nautical Almanac jsem zjistil
přesnou pozici GP v daný čas (00:00:34 UT)

GHA	176°26,9'
Incr (m/s)	0°08,5'
GHA	176°35,4'
DEC (NA) N / S	13°41,4'
d + - (-0,8)	0,0'
DEC N / S	13°41,4'

Co dál?



Captain
Thomas H.
Sumner

Navigator
Marcq Saint-
Hilaire



NEW AND ACCURATE METHOD
OF
FINDING A SHIP'S POSITION ATSEA,
BY PROJECTION ON MERRCATOR'S CHART.

WHEN THE LATITUDE, LONGITUDE, AND APPARENT TIME AT THE SHIP ARE UNCERTAIN; ONE ALTITUDE OF THE SUN, WITH THE TRUE GREENWICH TIME, DETERMINES,

FIRST,
THE TRUE BEARING OF THE LAND;

SECONDLY,
THE ERRORS OF LONGITUDE BY CHRONOMETER,
CONSEQUENT TO ANY ERROR IN THE LATITUDE;

THIRDLY,
THE SUN'S TRUE AZIMUTH.

WHEN TWO ALTITUDES ARE OBSERVED, AND THE ELAPSED TIME NOTED, THE TRUE LATITUDE IS PROJECTED; AND IF THE TIMES BE NOTED BY CHRONOMETER, THE TRUE LONGITUDE IS ALSO PROJECTED AT THE SAME OPERATION.

The Principles of the Method being fully explained and illustrated
by Problems, Examples, and Plates,

WITH RULES FOR PRACTICE, AND EXAMPLES FROM ACTUAL OBSERVATION.

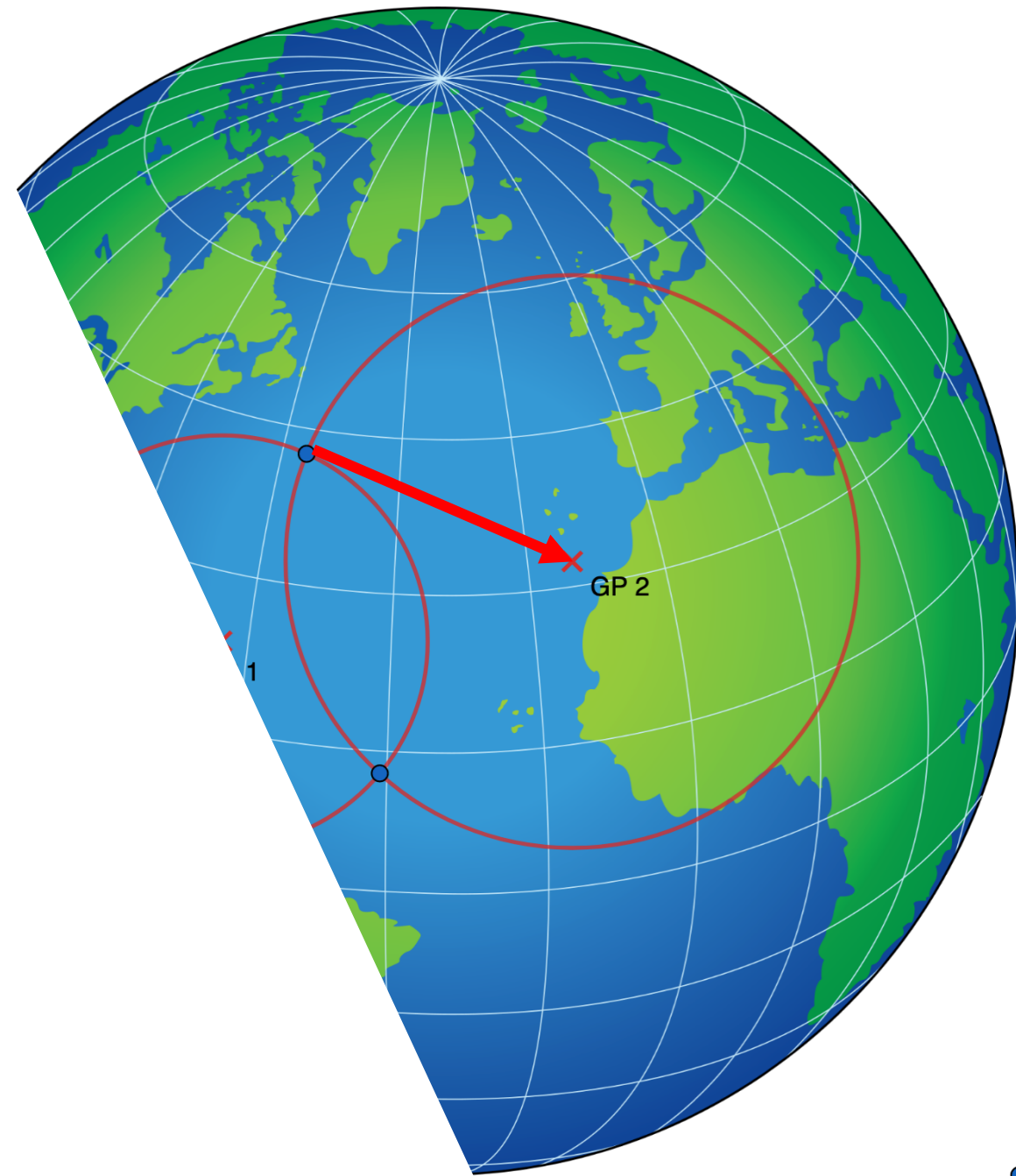
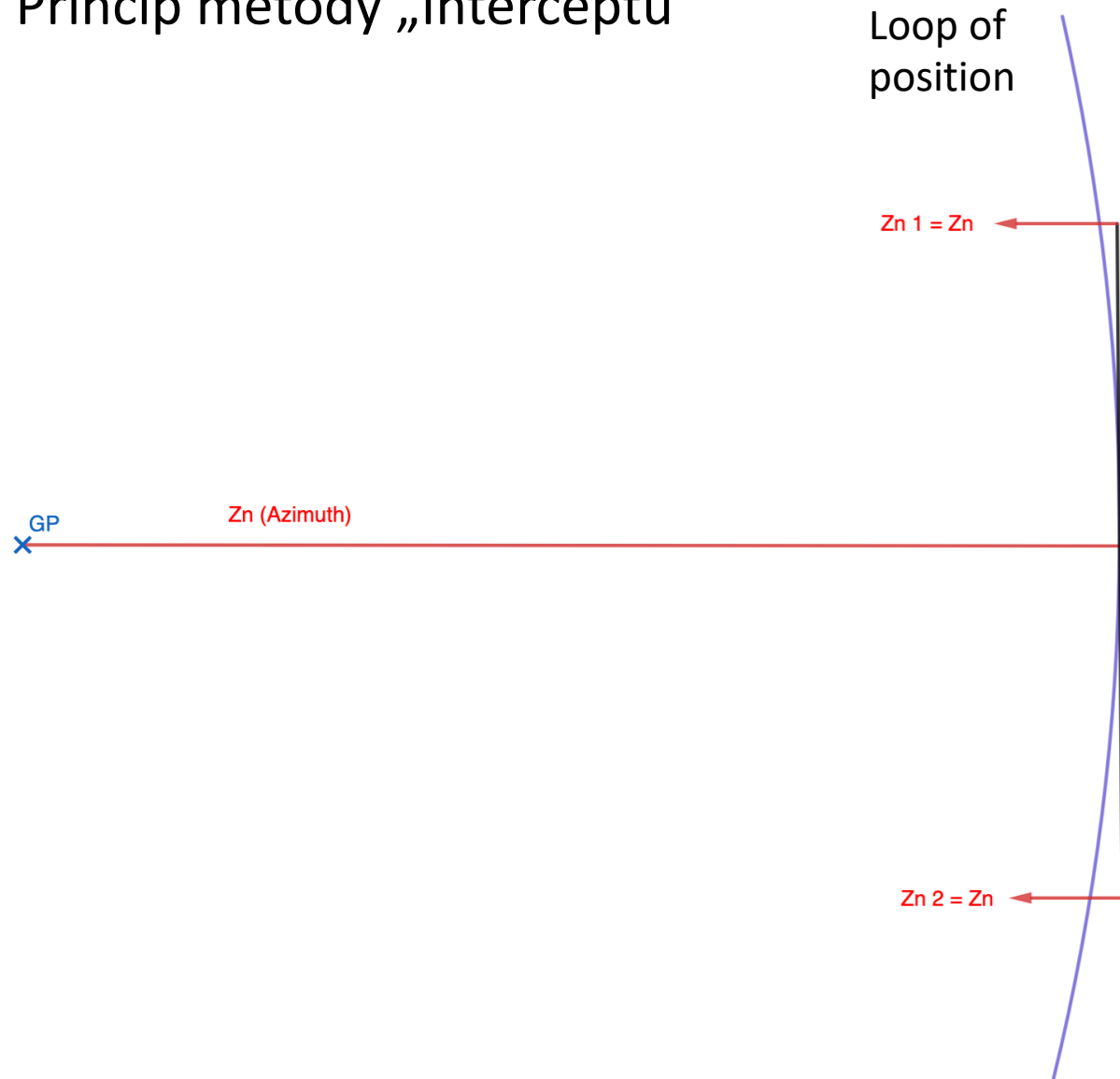
BY CAPT. THOMAS H. SUMNER.

SECOND EDITION.

BOSTON:

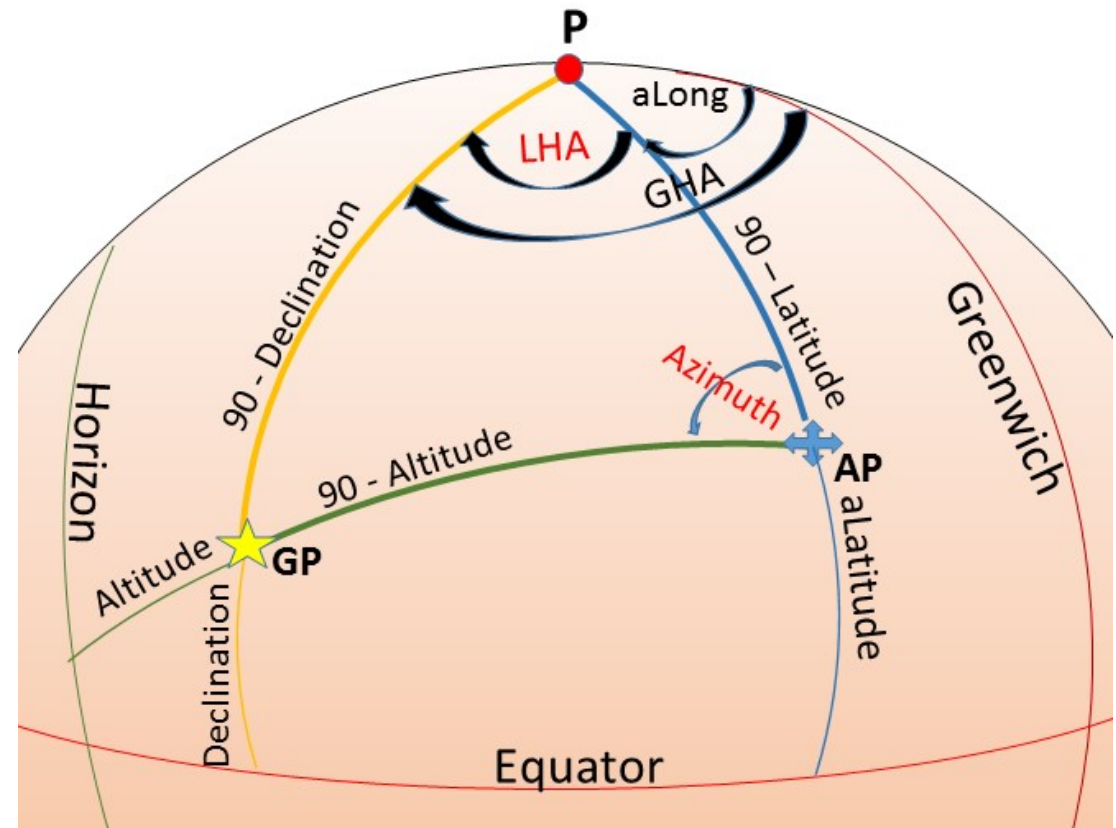
PUBLISHED BY THOMAS GROOM, 82 STATE STREET.
1845.

Princip metody „Interceptu“



Metoda interceptu - výpočet

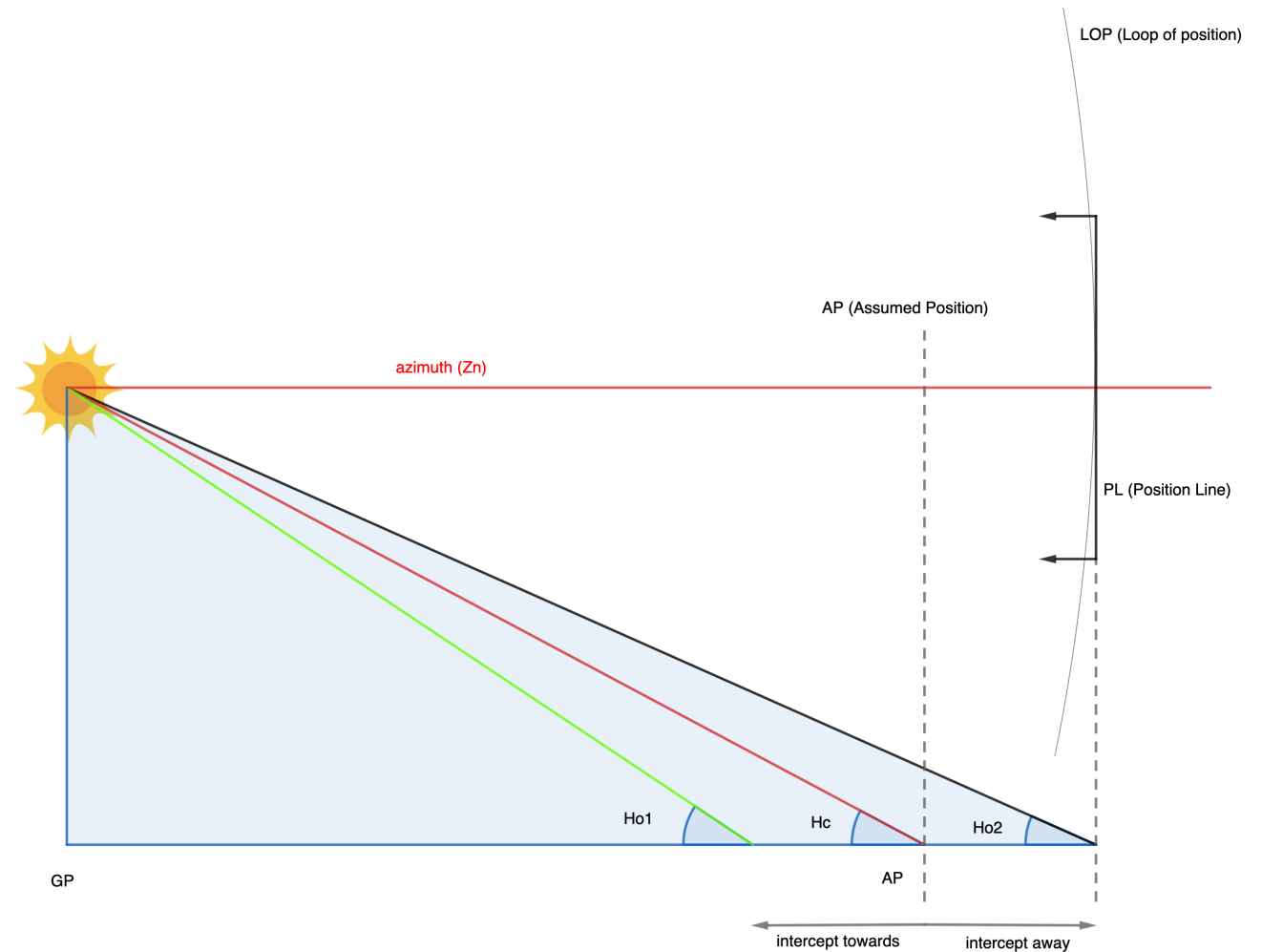
- H_c = kalkulovaná výška měření
 - Každé pozici (s celými stupni latitude) na zeměkouli odpovídá v daný čas určitá výška tělesa
- Z = hodnota, pomocí které určím Z_n (azimuth)
- $H_c = \sin^{-1}(\sin Dec \times \sin Lat + \cos Dec \times \cos Lat \times \cos LHA)$
- $Z = \cos^{-1}(\sin Dec \times \cos Lat + \cos Dec \times \sin Lat \times \cos LHA)$
- *N polokoule*
 - $LHA > 180^\circ$ potom $Z_n = Z$
 - $LHA < 180^\circ$ potom $Z_n = 360^\circ - Z$
- *S polokoule*
 - $LHA > 180^\circ$ potom $Z_n = 180^\circ - Z$
 - $LHA < 180^\circ$ potom $Z_n = 180^\circ + Z$



Metoda Interceptu – rozdíl mezi H_o a H_c

Pro použití metody interceptu potřebuji znát následující údaje

- **Pozici GP – znám**
 - GHA
 - Dec
- **LHA – znám**
- **H_o – znám**
- H_c – musím vypočítat
- Z_n – musím vypočítat



Výpočet a doplňování údajů do tabulky

SUN PRO FORMA SIGHT					
				Date:	
Object:	SUN			Watch time	
DR		N / S		corr:	
		W / E		GMT:	
GHA				DEC (NA) N / S	
Incr (m/s)				d/v + -	
GHA		(+360)		DEC N / S	
AP Long		W - / E +			SAME CONTR
LHA					
Hc		z			
d + -		180/360	LHA !		N: LHA > 180° Zn=Z LHA < 180° Zn=360-Z
Hc		Zn			S: LHA > 180° Zn=180 - Z LHA < 180° Zn=180+Z
Hs			LL+/UL-		
IE					
Dip -					
App. Alt.			O-M / A-S		
Ho					
Hc					
Intercept			TWD/AWY		

Výpočet a doplňování údajů do tabulky

ČERVENÉ údaje znám

ORANŽOVÉ údaje vyčtu z NA

ŽLUTÉ údaje vypočtu

SUN PRO FORMA SIGHT					
				Date:	
Object:				Watch time	
DR		N / S		corr:	
		W / E		GMT:	
GHA				DEC (NA) N / S	
Incr (m/s)				d/v + -	
GHA		(+360)		DEC N / S	
AP Long		W - / E +		SAME	CONTR
LHA		celé číslo!!!			
Hc		z			
d -		180/360	LHA !	N: LHA > 180° Zn=Z LHA < 180° Zn=360-Z	
Hc		Zn		S: LHA > 180° Zn=180 - Z LHA < 180° Zn=180+Z	
Hs			LL+ / UL -		
IE					
Dip -					
App. Alt.			O-M / A - S		
Ho					
Hc					
Intercept			TWD/AWY		

Vyplněná tabulka

SUN PRO FORMA SIGHT

				Date:	13. února 2021
Object:	SUN			Watch time	12:28:00
DR	25° 48' N			corr:	- 00:00:34
	22° 22' W			GMT:	12:27:26
GHA	356°27,0'			DEC (NA) N / S	13°11,2'
Incr (m/s)	6°51,5'			d/v +- (-0,8)	0,4'
GHA	003°18,5'	363°18,5' (+360)		DEC S	13°10,8'
AP Long	22°18,5'	W - / E +		SAME	CONTR
LHA	341	celé číslo!!!			
Hc	47°43' z		152°		
d - 54	10'	180/360	LHA !	N: LHA > 180° Zn=Z LHA < 180° Zn=360-Z	
Hc	47°33' Zn		152°	S: LHA > 180° Zn=180 - Z LHA < 180° Zn=180+Z	
Hs	46°26,8'	LL+			
IE	-----				
Dip -	- 4,0				
App. Alt.	+15,3	O-M			
Ho	46°42,1				
Hc	47°33'				
Intercept	51'	TWD/AWY			

ČERVENÉ údaje znám

ORANŽOVÉ údaje vyčtu z NA

ŽLUTÉ údaje vypočtu

Výpočet Hc a Z

Sight Reduction Tables

- HO 229
 - 6 dílů
 - Rozlišeno podle latitude
- HO 249
 - Zjednodušené pro leteckou navigaci
 - 3 díly
 - Rozlišeno podle latitude

**SIGHT REDUCTION
TABLES
FOR
MARINE NAVIGATION
LATITUDES 30° – 45°, Inclusive**

**PUB. NO. 229
VOLUME 3**

COMMERCIAL EDITION

L.H.A. 19°, 341°

0°		30°		Dec.
d	Z	Hc	d	
°	'	°	'	°

Latitude CONTRARY Name To Declination

25°			26°			27°			28°		
Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z

Latitude COI

25°		
Hc	d	Z

Dec.	23°				24°				25°				
	Hc	d	Z		Hc	d	Z		Hc	d	Z		
0	60	30.0	-47.9	138.6	59	44.6	-48.7	139.8	58	58.4	-49.5	140.8	58
1	59	42.0	48.6	139.8	58	55.8	49.3	140.9	58	08.9	50.0	141.9	57
2	58	53.5	49.2	141.0	58	06.5	49.8	142.0	57	18.9	50.5	142.9	56
3	58	04.3	49.7	142.1	57	16.7	50.3	143.0	56	28.5	50.9	143.9	55
4	57	14.6	50.2	143.1	56	26.3	50.8	144.0	55	37.5	51.4	144.9	54
5	56	24.4	-50.7	144.1	55	35.5	-51.2	145.0	54	46.2	-51.7	145.8	53
6	55	33.8	51.1	145.1	54	44.3	51.6	145.9	53	54.4	52.1	146.7	52
7	54	42.7	51.5	146.0	53	52.7	52.0	146.8	53	02.3	52.4	147.5	51
8	53	51.2	51.9	146.9	53	00.7	52.3	147.6	52	09.9	52.8	148.3	50
9	52	59.3	52.2	147.7	52	08.4	52.6	148.4	51	17.1	53.0	149.1	50
10	52	07.1	-52.5	148.5	51	15.8	-52.9	149.2	50	24.1	-53.3	149.8	49
11	51	14.6	52.8	149.3	50	22.8	53.2	149.9	49	30.7	53.6	150.5	48
12	50	21.8	53.1	150.1	49	29.6	53.5	150.6	48	37.2	53.8	151.2	47
13	49	28.7	53.4	150.8	48	36.1	53.7	151.3	47	43.4	54.0	151.9	46
14	48	35.3	53.6	151.5	47	42.4	53.9	152.0	46	49.3	54.2	152.5	45
15	47	41.7	-53.8	152.1	46	48.5	-54.1	152.6	45	55.1	-54.4	153.1	44
16	46	47.8	54.0	152.8	45	54.4	54.3	153.3	45	00.7	54.6	153.7	44
17	45	53.8	54.3	153.4	44	00.0	54.5	153.9	44	06.1	54.8	154.3	43
18	44	59.5	54.4	154.0	44	05.5	54.7	154.5	43	11.2	54.9	154.9	42

SUN PRO FORMA SIGHT

Object:	SUN	Date:	13. února 2021
DR	25° 48' N	Watch time	12:28:00
	22° 22' W	corr:	- 00:00:34
GHA	356°27,0'	GMT:	12:27:26
Incr (m/s)	6°51,5'	DEC (NA) N/S	13°11,2'
GHA	003°18,5' 363°18,5' (+360)	d/v + - (-0,8)	0,4'
AP Long	22°18,5 W - / E +	DEC <input checked="" type="checkbox"/> S	13°10,8'
LHA	341 celé číslo!!!	SAME	CONTR
Hc	47°43'	152°	
d - 54	10' 180/360	LHA !	N: LHA > 180° Zn=Z LHA < 180° Zn=360-Z
Hc	47°33' Zn	152°	S: LHA > 180° Zn=180 - Z LHA < 180° Zn=180+Z
Hs	46°26,8' II+		
IE	-----		
Dip -	- 4,0		
App. Alt	+15,3 O-M		
Ho	46°42,1		
Hc	47°33'		
Intercept	51' TWD/AWY		

47 43.4 54.0 151.9

AP – Assumed position (zvolená pozice)

LHA je úhlová vzdálenost mezi long. mé pozice a GHA

LHA musí být celé číslo
LHA musí být kladné číslo

- $LHA = GHA \pm \text{long.}$
 - E long. přičítám
 - W long. odečítám
- AP zvolím tak, aby vyšlo celé číslo
- Vypočtu LHA

GHA	356°27,0'	
Incr (m/s)	6°51,5'	
GHA	003°18,5'	363°18,5' (+360)
AP Long	22°18,5'	W - / E +
LHA	341	celé číslo!!!

25° 48'	N
22° 22'	W

Latitude CONTRARY Name To Declination L.H.A. 19°, 341°

Main table with columns for Dec., 23°, 24°, 25°, 26°, 27°, 28°, 29°, 30°, and Dec. containing numerical data for latitude and declination.

1. Kterou stránku zvolím?

LHA 341 celé číslo!!! 25° 48' N 22° 22' W

DEC (NA) N(S) 13°11,2' d/v + (-0,8) 0,4' DEC N(S) 13°10,8' SAME CONTR

S. Lat. { L.H.A. greater than 180Zn=180-Z L.H.A. less than 180Zn=180+Z Latitude SAME Name As Declination L.H.A. 161°, 199°

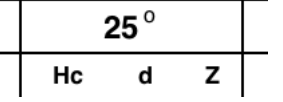
Latitude CONTRARY Name To Declination L.H.A. 19°, 341°

Table with columns for Dec., Latitude (23° to 30°), and Longitude (Hc, d, Z). It contains numerical data for each degree and minute interval.

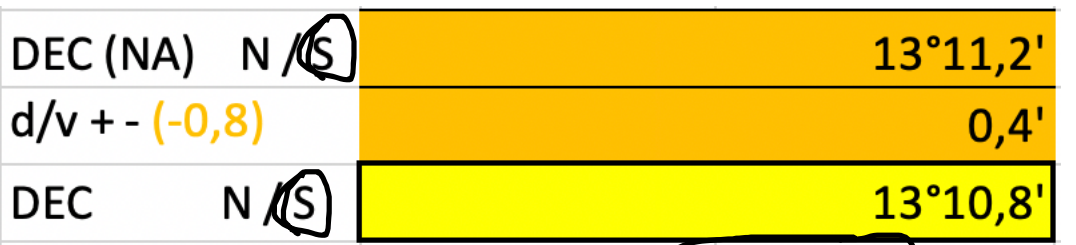
2. Vyhledám sloupec s mojím Lat.



Latitude COL



3. Vyhledám řádek s Dec slunce



SAME CONTR

Latitude CONTRARY Name To Declination L.H.A. 19°, 341°

Table with columns for Dec. (0-90), Latitude (23-30), and Declination (0-90). It contains a grid of numerical values for various celestial coordinates.

4. Vyhledám Hc, d, Z a Zn

Diagram showing the relationship between LHA, Hc, d, Z, and Zn. It includes text like '341 celé číslo!!!', '47°43' z', '10' 180/360', '47°33' Zn', and 'LHA !'. A large vertical bar is present on the right side.

47 43.4 54.0 151.9

5. Dopočtu Zn

N: LHA > 180° Zn=Z LHA < 180° Zn=360-Z
S: LHA > 180° Zn=180 - Z LHA < 180° Zn=180+Z

S. Lat. { L.H.A. greater than 180Zn=180-Z L.H.A. less than 180Zn=180+Z Latitude SAME Name As Declination L.H.A. 161°, 199°

Hotovo –
tabulka je
vyplněná
(skoro)

SUN PRO FORMA SIGHT					
				Date:	13. února 2021
Object:	SUN			Watch time	12:28:00
DR	25° 48' N			corr:	- 00:00:34
	22° 22' W			GMT:	12:27:26
GHA	356°27,0'			DEC (NA) N / S	13°11,2'
Incr (m/s)	6°51,5'			d/v +- (-0,8)	0,4'
GHA	003°18,5'	363°18,5' (+360)		DEC S	13°10,8'
AP Long	22°18,5'	W - / E +		SAME	CONTR
LHA	341	celé číslo!!!			
Hc	47°43' z		152°		
d - 54	10'	180/360	LHA !	N: LHA > 180° Zn=Z LHA < 180° Zn=360-Z	
Hc	47°33'	Zn	152°	S: LHA > 180° Zn=180 - Z LHA < 180° Zn=180+Z	
Hs			LL+		
IE					
Dip -					
App. Alt.			O-M		
Ho					
Hc	47°33'				
Intercept			TWD/AWY		



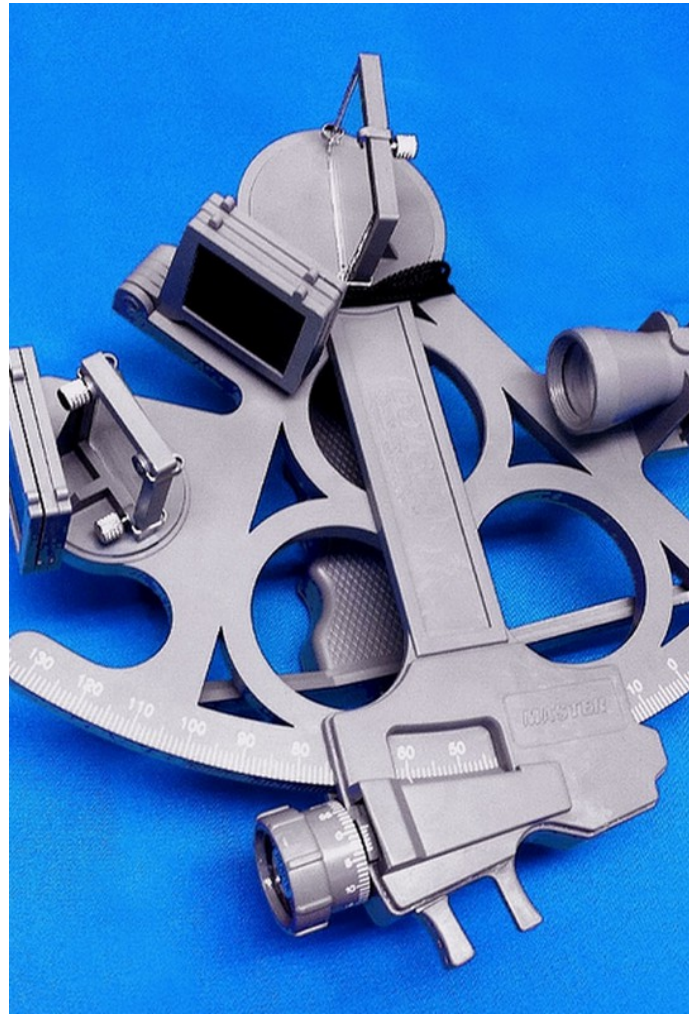
BOAL

25 Cents

0,-- Kč



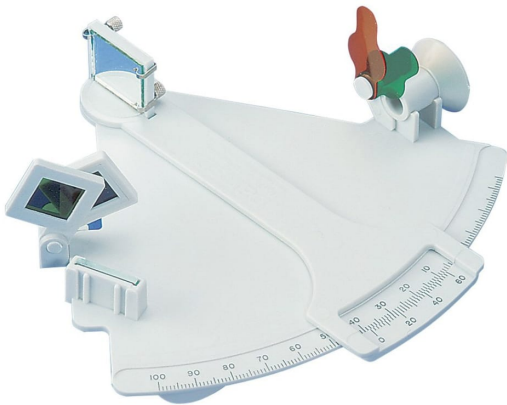
8.000,-- Kč

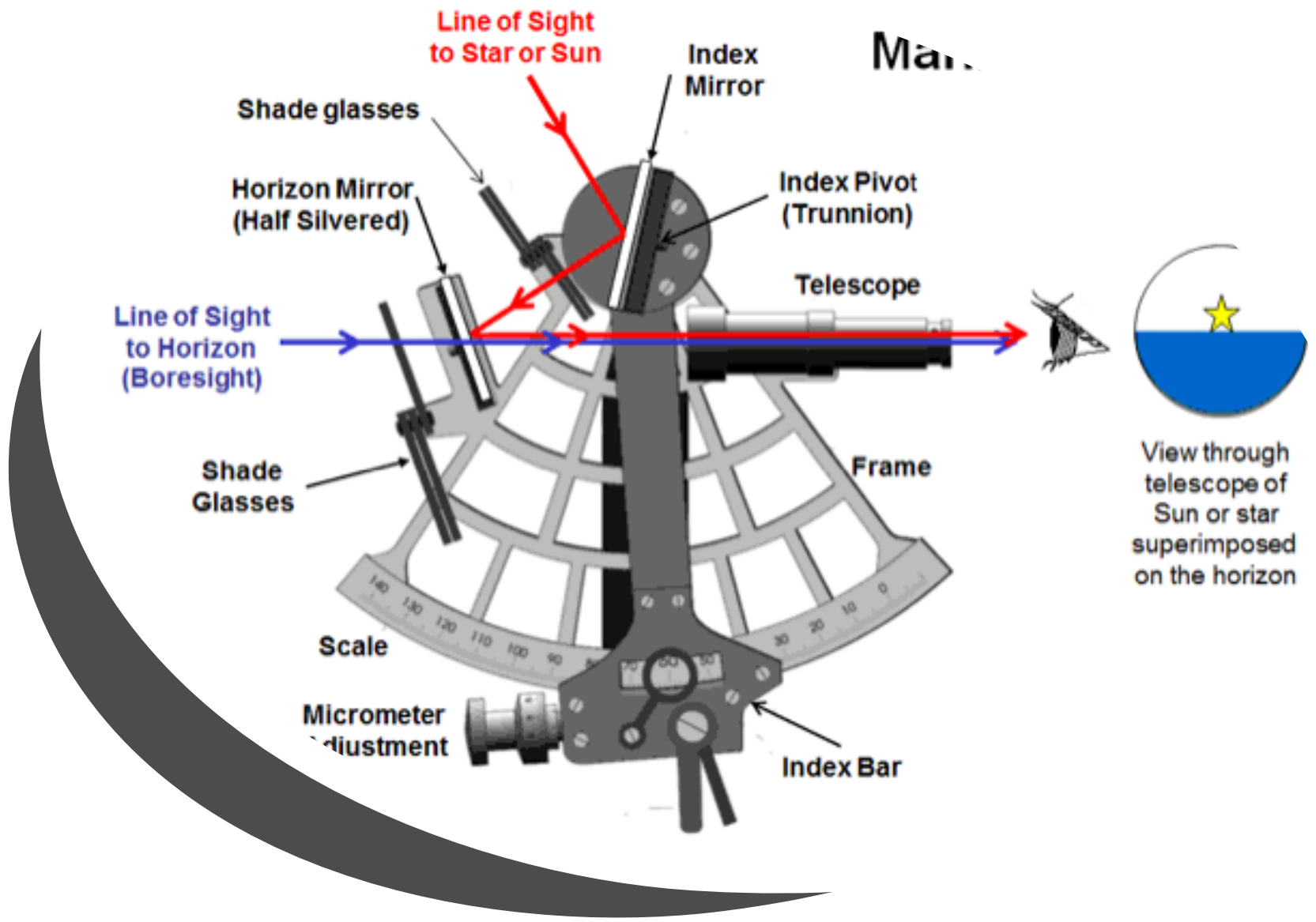


> 20.000,-- Kč



1.600,-- Kč

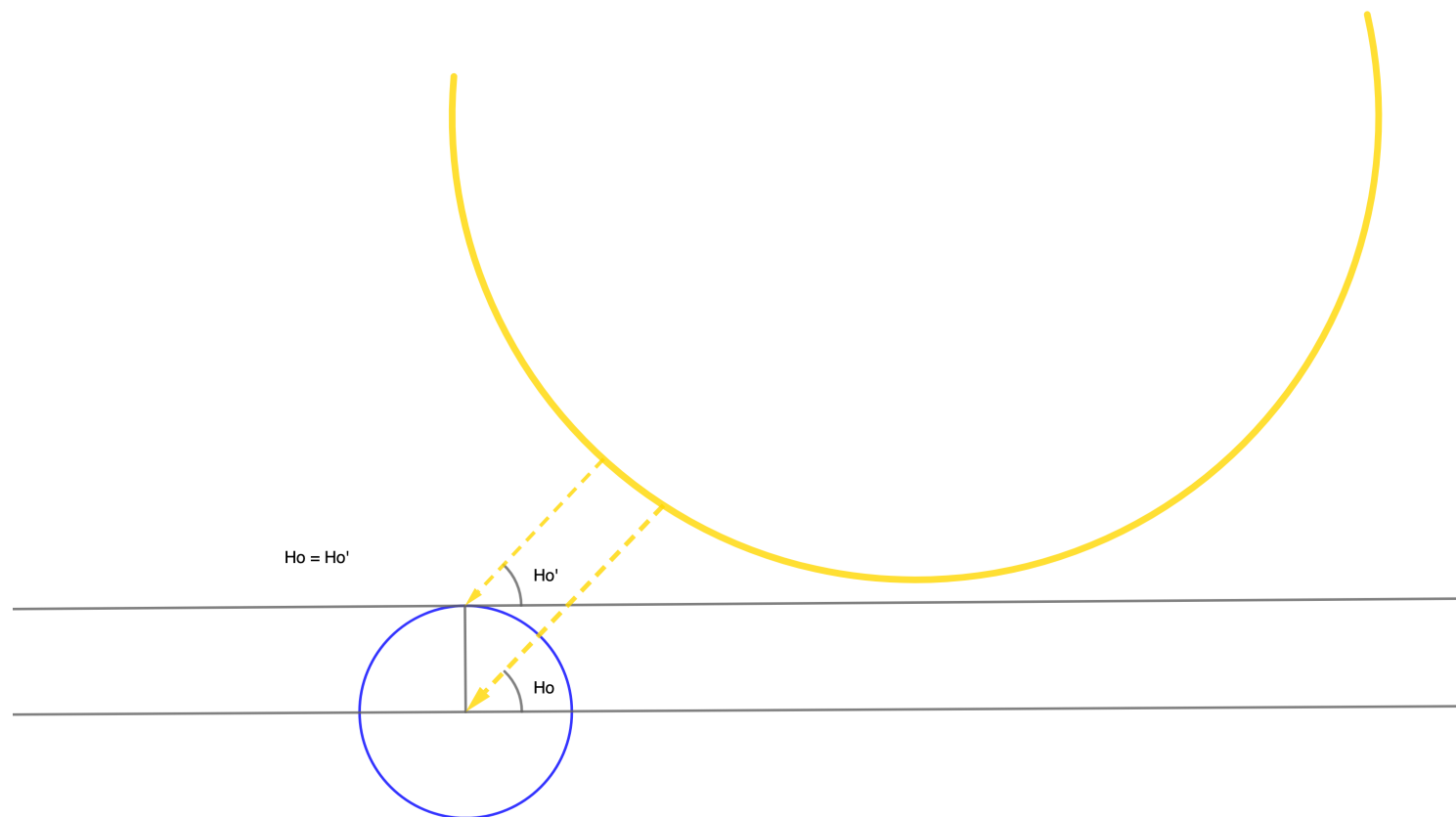




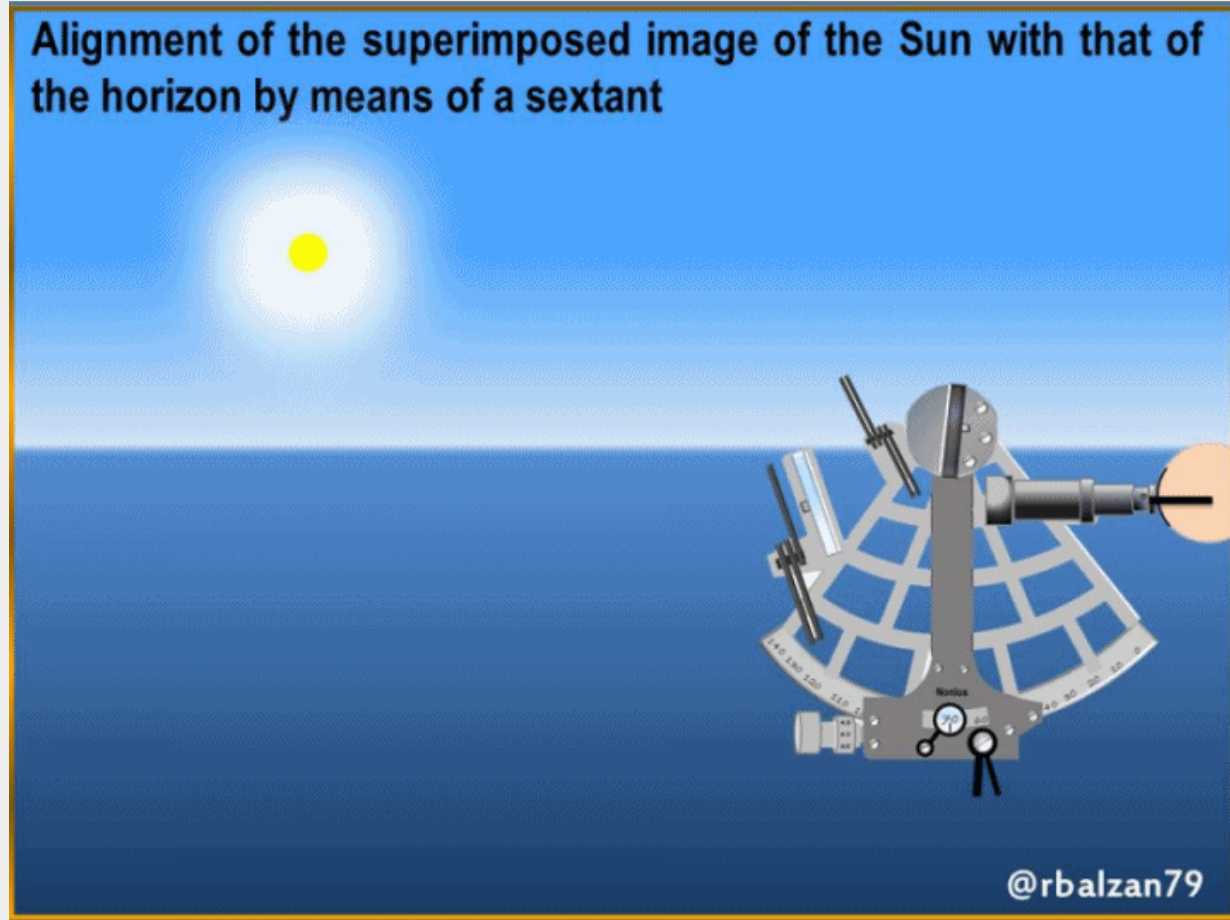
Mar.

View through telescope of Sun or star superimposed on the horizon

Výška nebeského tělesa nad obzorem

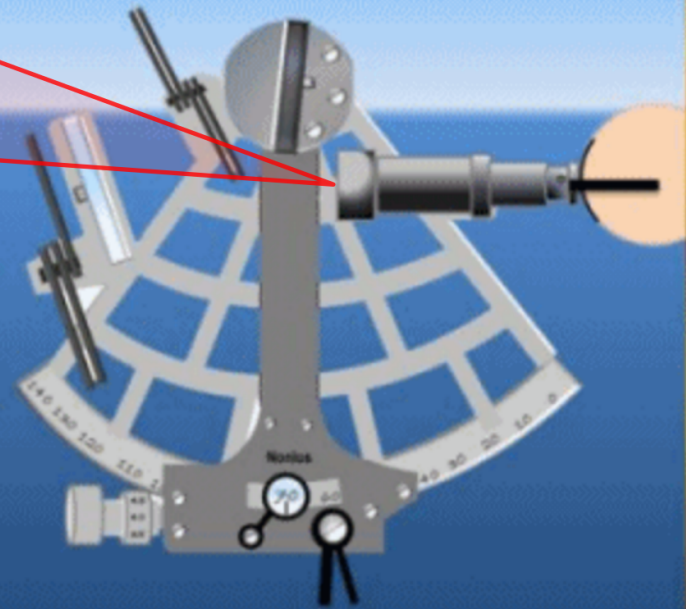


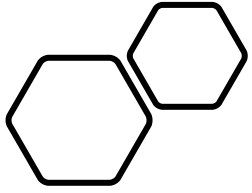
Alignment of the superimposed image of the Sun with that of the horizon by means of a sextant



Alignment of the superimposed image of the Sun with that of the horizon by means of a sextant

Hs - výška tělesa nad obzorem

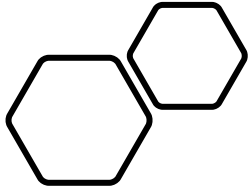




Seřízení sextantu

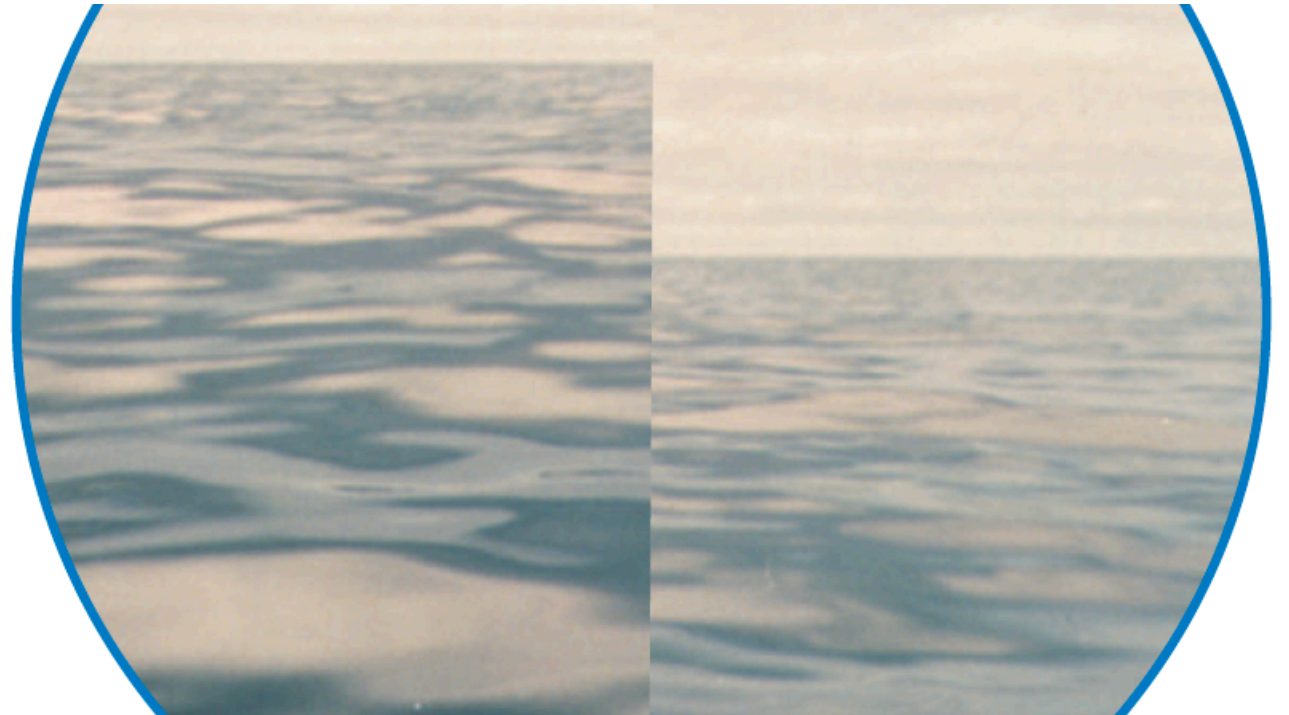
- kolmost zrcadla vůči ose sextantu
 - seřídít šrouby na zrcadle
- rovnoběžnost zrcadel – side error
 - seřídít šrouby na zrcadle
- chyba sextantu
 - chyba z výroby
 - korekční karta

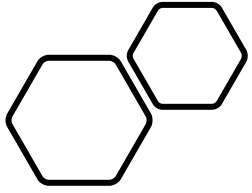




Index Error

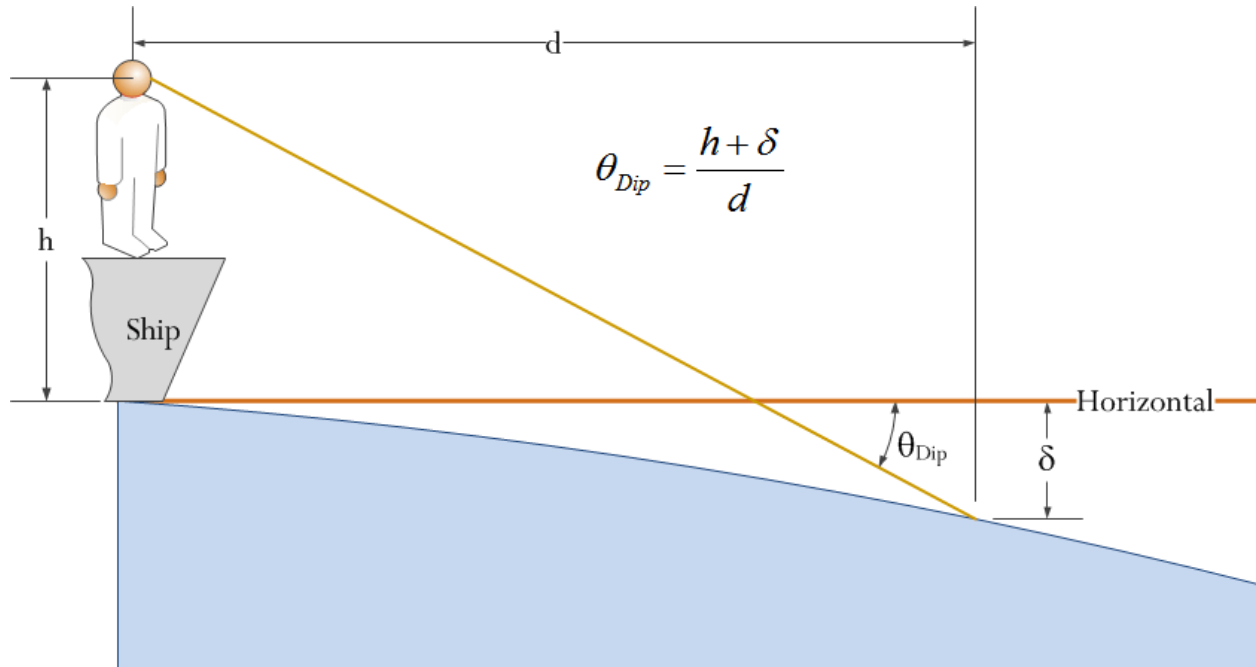
- Horizont není v rovině, když je sextant nastaven na 0°
- Lze eliminovat seřízením zrcadel
- Když nelze, nutno upravit při výpočtu
 - odečíst / přičíst
- Kontrolujeme před každým měřením

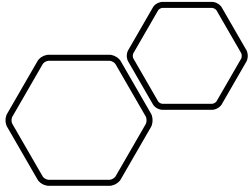




DIP

- DIP – úhel výšky nad hladinou oproti skutečnému horizontu
- zjistím z NA
- vždy se odečte

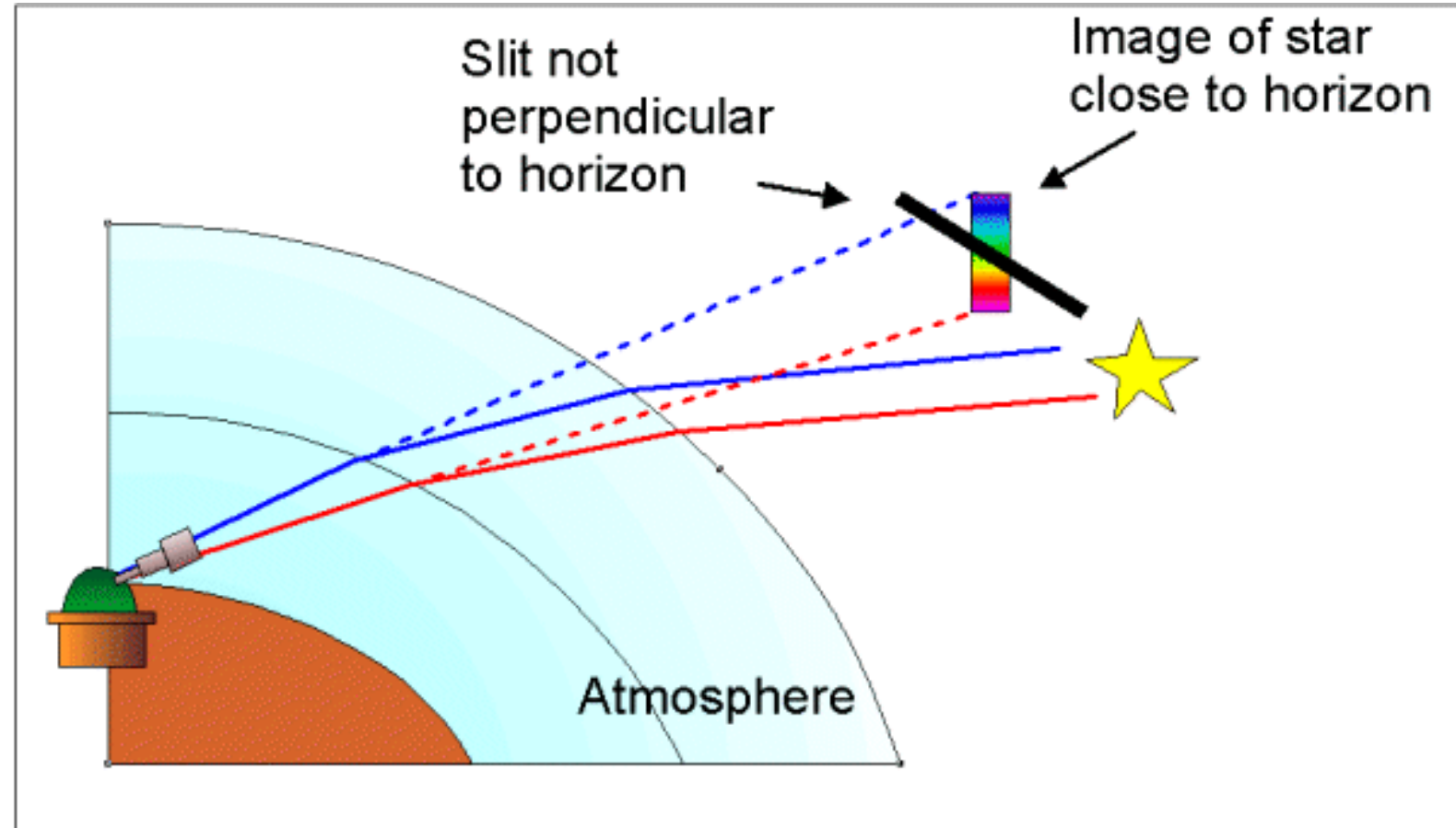




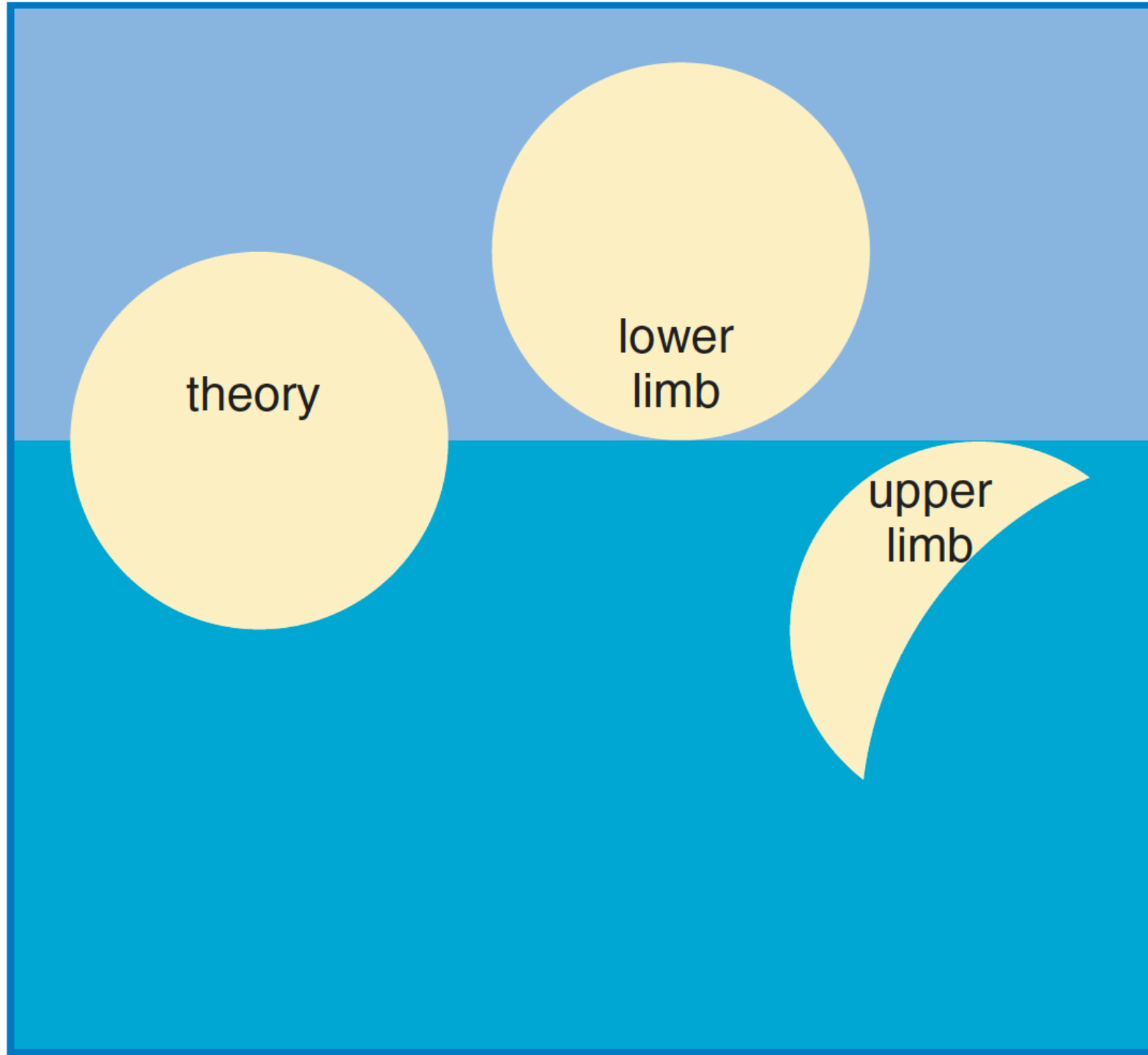
Další korekce

Altitude correction – souhrnná oprava pro SUN / Stars & Planets / Moon

- pro SUN
 - úprava UPPER LIMB / LOWER LIMB
 - úprava dle období
 - úprava dle naměřené výšky
- zahrnuje
 - refrakci
 - semidiametr – střed slunce
 - paralaxu – rovnoběžnost paprsků



- SUN – měříme na lower limb
- Měsíc – měříme ten, který je vidět
- Stars & Planets – měříme bod



App. Alt.	0°-4°		5°-9°		10°-14°		15°-19°		20°-24°		25°-29°		30°-34°		App. Alt.	
	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ		
	0	5	10	15	20	25	30		1	6	11	16	21	26	31	00
00	33.8	58.2	62.1	62.8	62.2	60.8	58.9	00								
10	35.9	58.5	62.2	62.8	62.1	60.8	58.8	10								
20	37.8	58.7	62.2	62.8	62.1	60.7	58.8	20								
30	39.6	58.9	62.3	62.8	62.1	60.7	58.7	30								
40	41.2	59.1	62.3	62.8	62.0	60.6	58.6	40								
50	42.6	59.3	62.4	62.7	62.0	60.6	58.5	50								
00	1	6	11	16	21	26	31	00								
10	44.0	59.5	62.4	62.7	62.0	60.5	58.5	10								
20	45.2	59.7	62.4	62.7	61.9	60.4	58.4	20								
30	46.3	59.9	62.5	62.7	61.9	60.4	58.3	30								
40	47.3	60.0	62.5	62.7	61.9	60.3	58.2	40								
50	48.3	60.2	62.5	62.7	61.8	60.3	58.2	50								
00	2	7	12	17	22	27	32	00								
10	50.0	60.5	62.6	62.7	61.7	60.1	58.0	10								
20	50.8	60.6	62.6	62.6	61.7	60.1	57.9	20								
30	51.4	60.7	62.6	62.6	61.6	60.0	57.8	30								
40	52.1	60.9	62.7	62.6	61.6	59.9	57.8	40								
50	52.7	61.0	62.7	62.6	61.5	59.9	57.7	50								
00	3	8	13	18	23	28	33	00								
10	53.8	61.2	62.7	62.5	61.5	59.7	57.5	10								
20	54.3	61.3	62.7	62.5	61.4	59.7	57.4	20								
30	54.8	61.4	62.7	62.5	61.4	59.6	57.4	30								
40	55.2	61.5	62.8	62.5	61.3	59.5	57.3	40								
50	55.6	61.6	62.8	62.4	61.3	59.5	57.2	50								
00	4	9	14	19	24	29	34	00								
10	56.4	61.7	62.8	62.4	61.2	59.4	57.1	10								
20	56.7	61.8	62.8	62.3	61.1	59.3	56.9	20								
30	57.1	61.9	62.8	62.3	61.1	59.2	56.9	30								
40	57.4	61.9	62.8	62.3	61.0	59.1	56.8	40								
50	57.7	62.0	62.8	62.2	60.9	59.1	56.7	50								
00	57.9	62.1	62.8	62.2	60.9	59.0	56.6	00								

DIP	
Ht. of Eye	Corr ⁿ
Ht. of Eye	Corr ⁿ
m	
0.3	-1.1
0.4	-1.2
0.5	-1.3
0.6	-1.4
0.7	-1.5
0.8	-1.6
0.9	-1.7
1.0	-1.8
1.1	-1.9
1.2	-2.0
1.3	-2.1
1.5	-2.2
1.6	-2.3
1.8	-2.4
1.9	-2.5
2.1	-2.6
2.3	-2.7
2.4	-2.8
2.6	-2.9
2.8	-3.0
3.0	-3.1
3.3	-3.2
3.6	-3.3
4.0	-3.4
4.5	-3.5
5.0	-3.6
5.5	-3.7
6.0	-3.8
6.5	-3.9
7.0	-4.0
7.5	-4.1
8.0	-4.2
8.5	-4.3
9.0	-4.4
9.5	-4.5
10.0	-4.6
10.5	-4.7
11.0	-4.8
11.5	-4.9
12.0	-5.0
12.5	-5.1
13.0	-5.2
13.5	-5.3

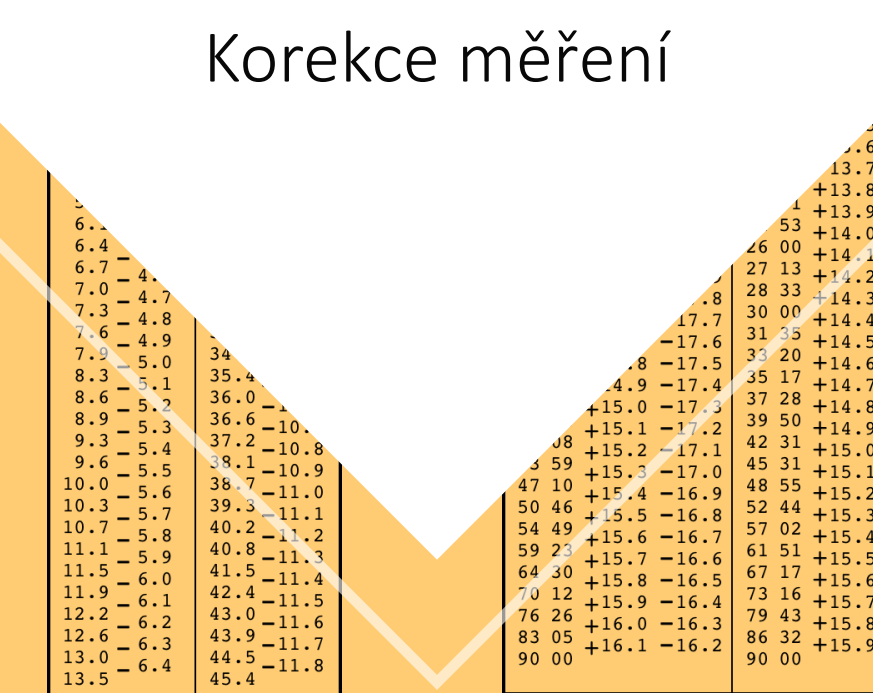
	OCT.- MAR.		SUN		APR.- SEPT.	
	App. Alt.	Lower Limb	Upper Limb	App. Alt.	Lower Limb	Upper Limb
°						
'						
9 34	+10.8	-21.5	9 39	+10.6	-21.2	
9 45	+10.9	-21.4	9 51	+10.7	-21.1	
9 56	+11.0	-21.3	10 03	+10.8	-21.0	
10 08	+11.1	-21.2	10 15	+10.9	-20.9	
10 21	+11.2	-21.1	10 27	+11.0	-20.8	
10 34	+11.3	-21.0	10 40	+11.1	-20.7	
10 47	+11.4	-20.9	10 54	+11.2	-20.6	
11 00	+11.5	-20.8	11 08	+11.3	-20.5	
11 15	+11.6	-20.7	11 23	+11.4	-20.4	
11 30	+11.7	-20.6	11 38	+11.5	-20.3	
11 45	+11.8	-20.5	11 54	+11.6	-20.2	
12 00	+11.9	-20.4	12 10	+11.7	-20.1	
12 15	+12.0	-20.3	12 28	+11.8	-20.0	
12 30	+12.1	-20.2	12 46	+11.9	-19.9	
12 45	+12.2	-20.1	13 05	+12.0	-19.8	
13 00	+12.3	-20.0	13 24	+12.1	-19.7	
13 15	+12.4	-19.9	13 45	+12.2	-19.6	
13 30	+12.5	-19.8	14 07	+12.3	-19.5	
13 45	+12.6	-19.7	14 30	+12.4	-19.4	
14 00	+12.7	-19.6	15 05	+12.5	-19.3	
14 15	+12.8	-19.5	15 30	+12.6	-19.2	
14 30	+12.9	-19.4	16 05	+12.7	-19.1	
14 45	+13.0	-19.3	16 30	+12.8	-19.0	
15 00	+13.1	-19.2	17 05	+12.9	-18.9	
15 15	+13.2	-19.1	17 30	+13.0	-18.8	
15 30	+13.3	-19.0	18 05	+13.1	-18.7	
15 45	+13.4	-18.9	18 30	+13.2	-18.6	
16 00	+13.5	-18.8	19 05	+13.3	-18.5	
16 15	+13.6	-18.7	19 30	+13.4	-18.4	
16 30	+13.7	-18.6	20 05	+13.5	-18.3	
16 45	+13.8	-18.5	20 30	+13.6	-18.2	
17 00	+13.9	-18.4	21 05	+13.7	-18.1	
17 15	+14.0	-18.3	21 30	+13.8	-18.0	
17 30	+14.1	-17.9	22 05	+13.9	-17.9	
17 45	+14.2	-17.8	22 30	+14.0	-17.8	
18 00	+14.3	-17.7	23 05	+14.1	-17.7	
18 15	+14.4	-17.6	23 30	+14.2	-17.6	
18 30	+14.5	-17.5	24 05	+14.3	-17.5	
18 45	+14.6	-17.4	24 30	+14.4	-17.4	
19 00	+14.7	-17.3	25 05	+14.5	-17.3	
19 15	+14.8	-17.2	25 30	+14.6	-17.2	
19 30	+14.9	-17.1	26 05	+14.7	-17.1	
19 45	+15.0	-17.0	26 30	+14.8	-17.0	
20 00	+15.1	-16.9	27 05	+14.9	-16.9	
20 15	+15.2	-16.8	27 30	+15.0	-16.8	
20 30	+15.3	-16.7	28 05	+15.1	-16.7	
20 45	+15.4	-16.6	28 30	+15.2	-16.6	
21 00	+15.5	-16.5	29 05	+15.3	-16.5	
21 15	+15.6	-16.4	29 30	+15.4	-16.4	
21 30	+15.7	-16.3	30 05	+15.5	-16.3	
21 45	+15.8	-16.2	30 30	+15.6	-16.2	
22 00	+15.9	-16.1	31 05	+15.7	-16.1	
22 15	+16.0	-16.0	31 30	+15.8	-16.0	
22 30	+16.1	-15.9	00 00	+15.9	-15.9	

STARS AND PLANETS	
App. Alt.	Corr ⁿ
App. Additional Alt.	Corr ⁿ
°	
'	
9 56	-5.3
10 08	-5.2
10 20	-5.1
10 33	-5.0
10 46	-4.9
11 00	-4.8
11 14	-4.7
11 29	-4.6
11 45	-4.5
12 01	-4.4
12 18	-4.3
12 35	-4.2
12 54	-4.1
13 13	-4.0
13 33	-3.9
13 54	-3.8
14 16	-3.7
14 40	-3.6
15 04	-3.5
15 30	-3.4
15 57	-3.3
16 26	-3.2
16 56	-3.1
17 28	-3.0
18 02	-2.9
18 38	-2.8
19 17	-2.7
19 58	-2.6
20 42	-2.5
21 28	-2.4
22 19	-2.3
23 13	-2.2
24 11	-2.1
25 14	-2.0
26 22	-1.9
27 36	-1.8
28 56	-1.7
30 24	-1.6
32 00	-1.5
33 45	-1.4
35 40	-1.3
37 48	-1.2
40 08	-1.1
42 44	-1.0
45 36	-0.9
48 47	-0.8
52 18	-0.7
56 11	-0.6
60 28	-0.5
65 08	-0.4
70 11	-0.3
75 34	-0.2
81 13	-0.1
87 03	0.0
90 00	0.0

2021
VENUS
Feb. 13
0 +0.1
56

MARS
Feb. 13
0 +0.1
64

DIP	
Ht. of Eye	Corr ⁿ
Ht. of Eye	Corr ⁿ
m	
0.3	-1.1
0.4	-1.2
0.5	-1.3
0.6	-1.4
0.7	-1.5
0.8	-1.6
0.9	-1.7
1.0	-1.8
1.1	-1.9
1.2	-2.0
1.3	-2.1
1.5	-2.2
1.6	-2.3
1.8	-2.4
1.9	-2.5
2.1	-2.6
2.3	-2.7
2.4	-2.8
2.6	-2.9
2.8	-3.0
3.0	-3.1
3.2	-3.2
3.4	-3.3
3.6	-3.4
3.8	-3.5
4.1	-3.6
4.3	-3.7
4.5	-3.8
4.8	-3.9
5.0	-4.0
5.3	-4.1
5.6	-4.2
5.8	-4.3
6.1	-4.4
6.4	-4.5
6.7	-4.6
7.0	-4.7
7.3	-4.8
7.6	-4.9
7.9	-5.0
8.3	-5.1
8.6	-5.2
8.9	-5.3
9.3	-5.4
9.6	-5.5
10.0	-5.6
10.3	-5.7
10.7	-5.8
11.1	-5.9
11.5	-6.0
11.9	-6.1
12.2	-6.2
12.6	-6.3
13.0	-6.4
13.5	-6.4



All altitude correction tables are based on data published in the 1961 Nautical Almanac to comply with copyright laws. Only minor changes - mostly with refraction at altitudes below 10 degrees - have been made in the current publications.

All altitude correction tables are based on data published in the 1961 Nautical Almanac to comply with copyright laws. Only minor changes - mostly with refraction at altitudes below 10 degrees - have been made in the current publications.

Index bar



Hlavní
stupnice



Mikrometr

(Pierre Vernier)



OCT.-MAR.			APR.-SEPT.			STARS AND PLANETS		DIP	
App. Alt.	Lower Limb	Upper Limb	App. Alt.	Lower Limb	Upper Limb	App. Corr ⁿ	App. Additional Corr.	Ht. of Corr ⁿ	Ht. of Corr ⁿ
2003									
VENUS									
9 34	+10.8	-21.5	9 39	+10.6	-21.2	9 56	-5.3	2.4	-2.8
9 45	+10.9	-21.4	9 51	+10.7	-21.1	10 08	-5.2	2.6	-2.9
9 56	+11.0	-21.3	10 03	+10.8	-21.0	10 20	-5.1	2.8	-2.9
10 08	+11.1	-21.2	10 15	+10.9	-20.9	10 33	-5.0	3.0	-3.0
10 21	+11.2	-21.1	10 27	+11.0	-20.8	10 46	-4.9	3.2	-3.1
10 34	+11.3	-21.0	10 40	+11.1	-20.7	11 00	-4.9	3.4	-3.2
10 47	+11.4	-20.9	10 54	+11.2	-20.6	11 14	-4.7	3.6	-3.3
11 01	+11.5	-20.8	11 08	+11.3	-20.5	11 29	-4.6	3.8	-3.4
11 15	+11.6	-20.7	11 23	+11.4	-20.4	11 45	-4.5	4.0	-3.5
11 30	+11.7	-20.6	11 38	+11.5	-20.3	12 01	-4.5	4.3	-3.6
11 46	+11.8	-20.5	11 54	+11.6	-20.2	12 18	-4.4	4.5	-3.7
12 02	+11.9	-20.4	12 10	+11.7	-20.1	12 35	-4.2	4.7	-3.8
12 19	+12.0	-20.3	12 28	+11.8	-20.0	12 54	-4.1	5.0	-4.0
12 37	+12.1	-20.2	12 46	+11.9	-19.9	13 13	-4.0	5.2	-4.1
12 55	+12.2	-20.1	13 05	+12.0	-19.8	13 33	-3.9	5.5	-4.2
13 14	+12.3	-20.0	13 24	+12.1	-19.7	13 54	-3.8	5.8	-4.3
13 35	+12.4	-19.9	13 45	+12.2	-19.6	14 16	-3.7	6.1	-4.4
13 56	+12.5	-19.8	14 07	+12.3	-19.5	14 40	-3.6	6.3	-4.4
14 18	+12.6	-19.7	14 30	+12.4	-19.4	15 04	-3.5	6.6	-4.5
14 42	+12.7	-19.6	14 54	+12.5	-19.3	15 30	-3.4	6.9	-4.6
15 06	+12.8	-19.5	15 19	+12.6	-19.2	16 00	-3.3	7.2	-4.7
15 32	+12.9	-19.4	15 46	+12.7	-19.1	16 26	-3.2	7.5	-4.8
15 59	+13.0	-19.3	16 14	+12.8	-19.0	16 56	-3.1	7.9	-4.9
16 28	+13.1	-19.2	16 44	+12.9	-18.9	17 28	-3.0	8.2	-5.0
16 59	+13.2	-19.1	17 15	+13.0	-18.8	18 02	-2.9	8.5	-5.1
17 32	+13.3	-19.0	17 48	+13.1	-18.7	18 38	-2.8	8.8	-5.2
18 06	+13.4	-18.9	18 24	+13.2	-18.6	19 17	-2.7	9.2	-5.3
18 42	+13.5	-18.8	19 01	+13.3	-18.5	19 58	-2.6	9.5	-5.4
19 21	+13.6	-18.7	19 42	+13.4	-18.4	20 42	-2.6	9.9	-5.5
20 03	+13.7	-18.6	20 25	+13.5	-18.3	21 28	-2.5	10.3	-5.6
20 48	+13.8	-18.5	21 11	+13.6	-18.2	22 19	-2.4	10.6	-5.7
21 35	+13.9	-18.4	22 00	+13.7	-18.1	23 13	-2.3	11.0	-5.8
22 26	+14.0	-18.3	22 54	+13.8	-18.0	24 11	-2.2	11.4	-5.9
23 22	+14.1	-18.2	23 51	+13.9	-17.9	25 14	-2.1	11.8	-6.0
24 21	+14.2	-18.1	24 53	+14.0	-17.8	26 22	-1.9	12.2	-6.2
25 26	+14.3	-18.0	25 40	+14.1	-17.7	27 36	-1.8	12.6	-6.3
26 36	+14.4	-17.9	26 33	+14.2	-17.6	28 56	-1.7	13.0	-6.4
27 52	+14.5	-17.8	27 52	+14.3	-17.5	30 24	-1.6	13.4	-6.5
29 15	+14.6	-17.7	29 15	+14.4	-17.4	32 00	-1.5	13.8	-6.6
30 46	+14.7	-17.6	31 35	+14.5	-17.3	33 45	-1.4	14.2	-6.7
32 26	+14.8	-17.5	33 20	+14.6	-17.2	35 40	-1.3	14.7	-6.8
34 17	+14.9	-17.4	35 17	+14.7	-17.1	37 48	-1.2	15.1	-6.9
36 20	+15.0	-17.3	37 26	+14.8	-17.0	40 08	-1.1	15.5	-7.0
38 36	+15.1	-17.2	39 50	+14.9	-16.9	42 44	-1.0	16.0	-7.1
41 08	+15.2	-17.1	42 31	+15.0	-16.8	45 36	-0.9	16.5	-7.2
43 59	+15.3	-17.0	45 31	+15.1	-16.7	48 47	-0.8	16.9	-7.2
47 10	+15.4	-16.9	48 55	+15.2	-16.6	52 18	-0.7	17.4	-7.4
50 46	+15.5	-16.8	52 44	+15.3	-16.5	56 11	-0.6	17.9	-7.5
54 49	+15.6	-16.7	57 02	+15.4	-16.4	60 28	-0.5	18.4	-7.6
59 23	+15.7	-16.6	61 51	+15.5	-16.3	65 08	-0.4	18.8	-7.7
64 30	+15.8	-16.5	67 17	+15.6	-16.2	70 11	-0.3	19.3	-7.8
70 12	+15.9	-16.4	73 16	+15.7	-16.1	75 34	-0.2	19.8	-7.9
76 26	+16.0	-16.3	79 43	+15.8	-16.0	81 13	-0.1	20.4	-8.0
83 05	+16.1	-16.2	86 32	+15.9	-15.9	87 03	0.0	20.9	-8.1
90 00			90 00			90 00	0.0	21.4	-8.1

Naměřená hodnota sextantem - Hs

Objekt: SUN

Datum: 13. února 2021

Výška nad hladinou: 5 metrů

Náměr: LL (lower limb - spodní okraj slunce)

Naměřená hodnota sextantem: 46° 26,8'

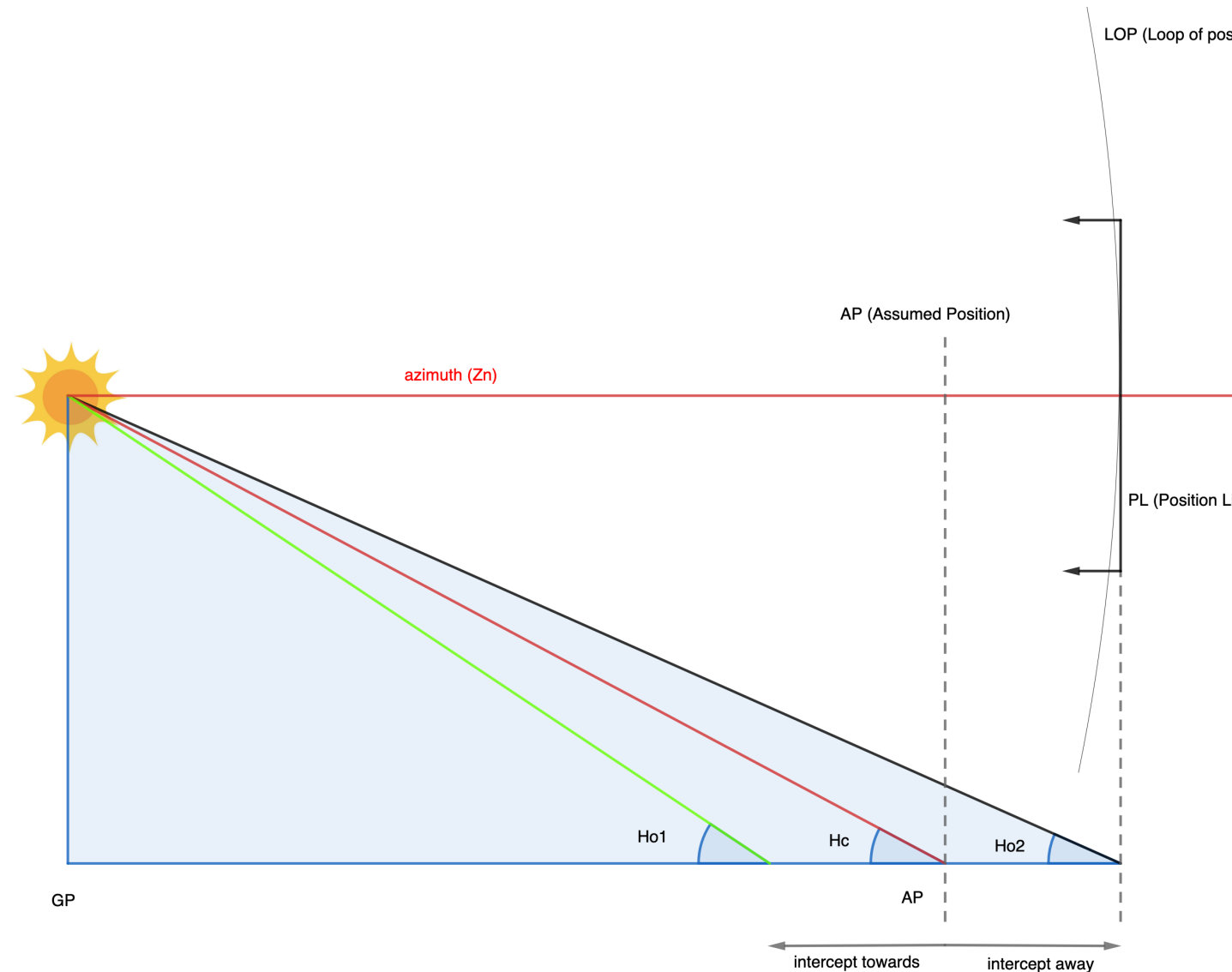
Hs	46° 26,8'	LL +	UP -
IE	-----		
Dip	- 3,9'		
App. Alt.	+ 15,3'	O-M	A-S
Ho	46° 38,2'		

Intercept

Hs	46°26,8'	LL+
IE	-----	
Dip -	- 4,0	
App. Alt.	+15,3	O-M
Ho	46°42,1	
Hc	47°33'	
Intercept	51'	AWY

Ho < Hc potom AWAY

Ho > Hc potom TOWARDS



SUN PRO FORMA SIGHT			
			Date: 13. února 2021
Object:	SUN		
			Watch time 12:28:00
DR	25° 48' N		corr: - 00:00:34
	22° 22' W		GMT: 12:27:26
GHA	356°27,0'	DEC (NA) N / S	13°11,2'
Incr (m/s)	6°51,5'	d/v + - (-0,8)	0,4'
GHA	363°18,6'	DEC S	13°10,8'
AP Long	22°18,6' W - / E +	SAME	CONTR
LHA	341		celé číslo!!!
Hc	47°43' z		152°
d - 54	10' 180/360		LHA !
Hc	47°33' Zn		152°
			N: LHA > 180° Zn=Z LHA < 180° Zn=360-Z S: LHA > 180° Zn=180 - Z LHA < 180° Zn=180+Z
Hs	46°26,8'		LL+
IE	-----		
Dip -	- 4,0		
App. Alt.	+15,3		O-M
Ho	46°42,1		
Hc	47°33'		
Intercept	51'		AWY

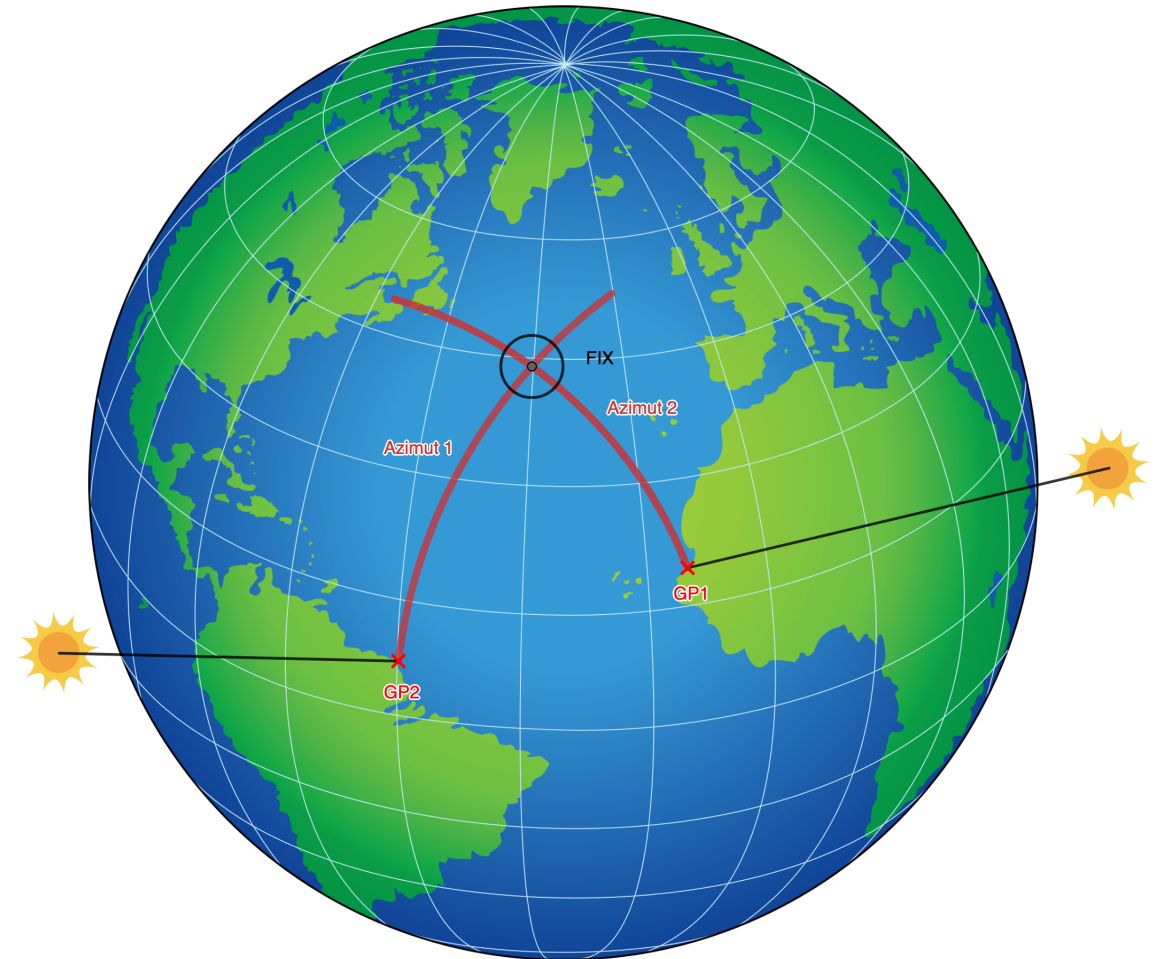
SUN PRO FORMA SIGHT			
			Date: 13. února 2021
Object:	SUN		
			Watch time 15:35:00
DR	26° 02' N		corr: - 00:02:39
	22° 10' W		GMT: 15:32:21
GHA	41°27,1'	DEC (NA) N / S	13°08,6'
Incr (m/s)	8°05,3'	d/v + - (-0,8)	0,4'
GHA	49°32,4'	DEC S	13°08,4'
AP Long	22°32,4' W - / E +	SAME	CONTR
LHA	27		celé číslo!!!
Hc	42°59' z		143°
d - 50	7' 180/360		LHA !
Hc	42°52' Zn		257°
			N: LHA > 180° Zn=Z LHA < 180° Zn=360-Z S: LHA > 180° Zn=180 - Z LHA < 180° Zn=180+Z
Hs	42°21,6'		LL+
IE	-----		
Dip -	- 4,0		
App. Alt.	+14,9		O-M
Ho	42°22,5		
Hc	42°52'		
Intercept	29,5'		AWY

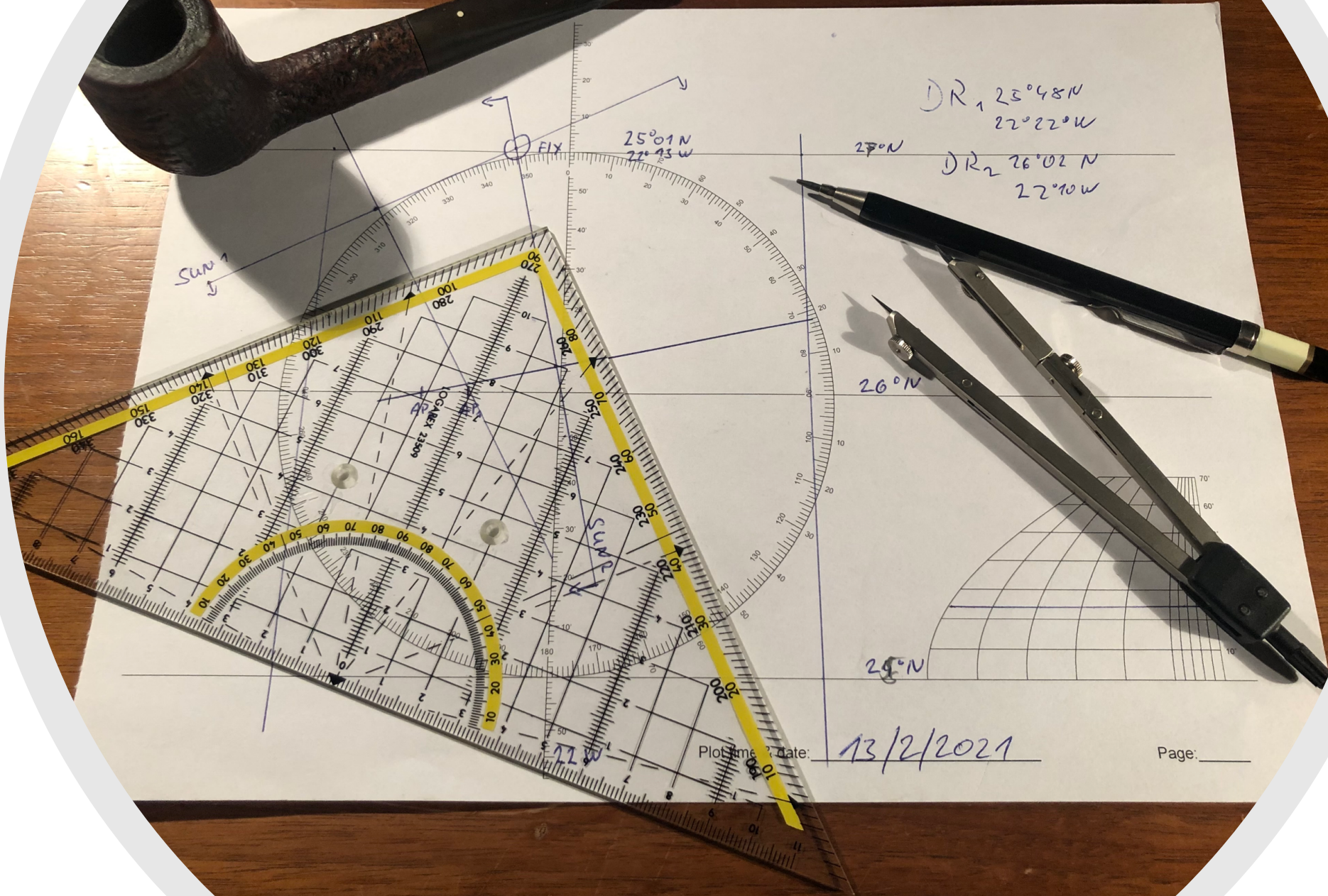
Určení polohy v astronavigaci

Pro určení polohy potřebují DVA body
(mimo situace určení polohy v pravé poledne)

Možnosti:

- SUN – SUN
 - Zastavím loď na místě a počkám, než bude slunce na jiném místě
 - Nejméně 4 hodiny
 - Kotva?
 - Heave to?
- SUN – run – SUN
 - Obdobná varianta jako running fix u terestrické navigace
- Určení polohy jiných těles
 - SUN – Moon
 - SUN – Stars & Planets
 - Stars & Planets

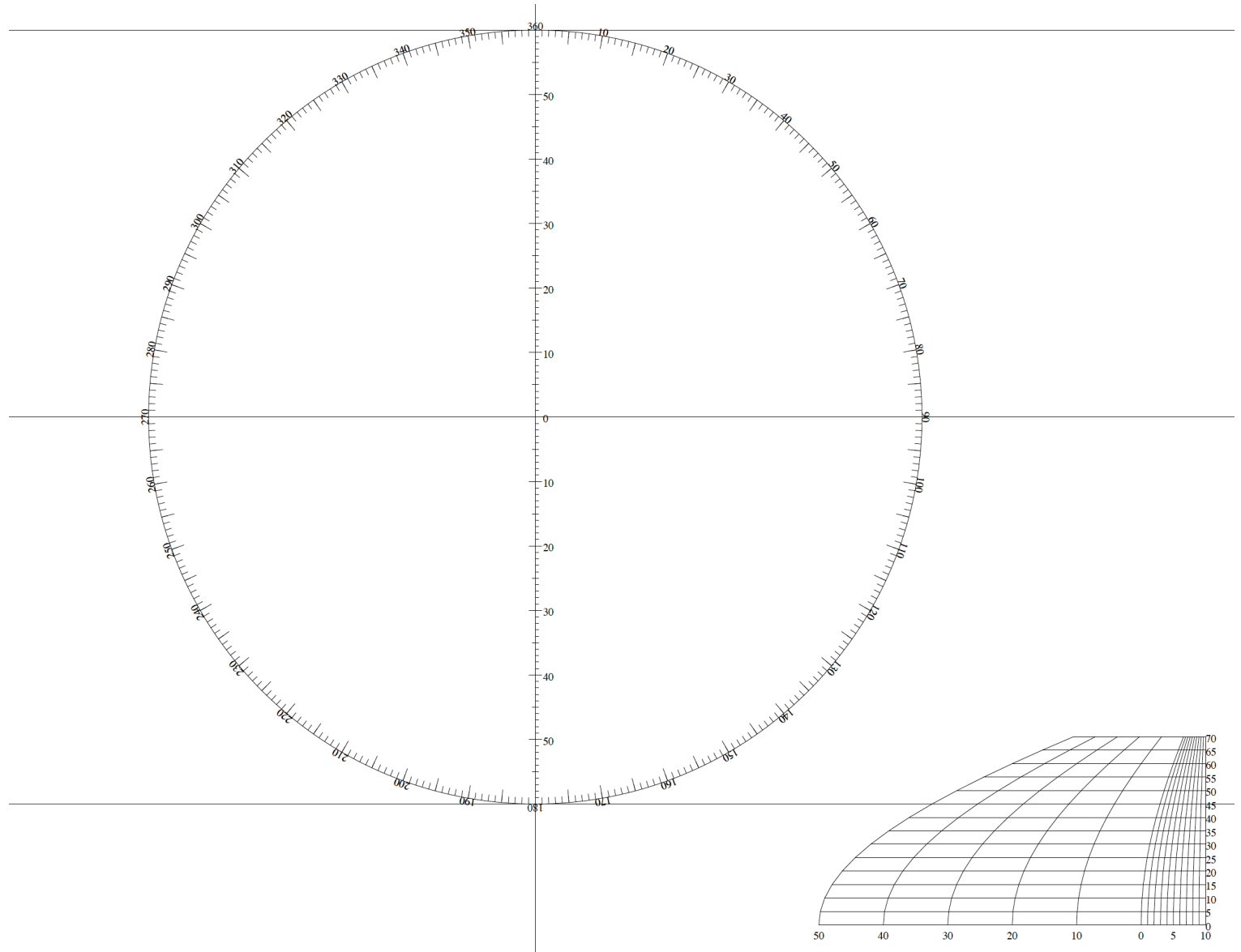


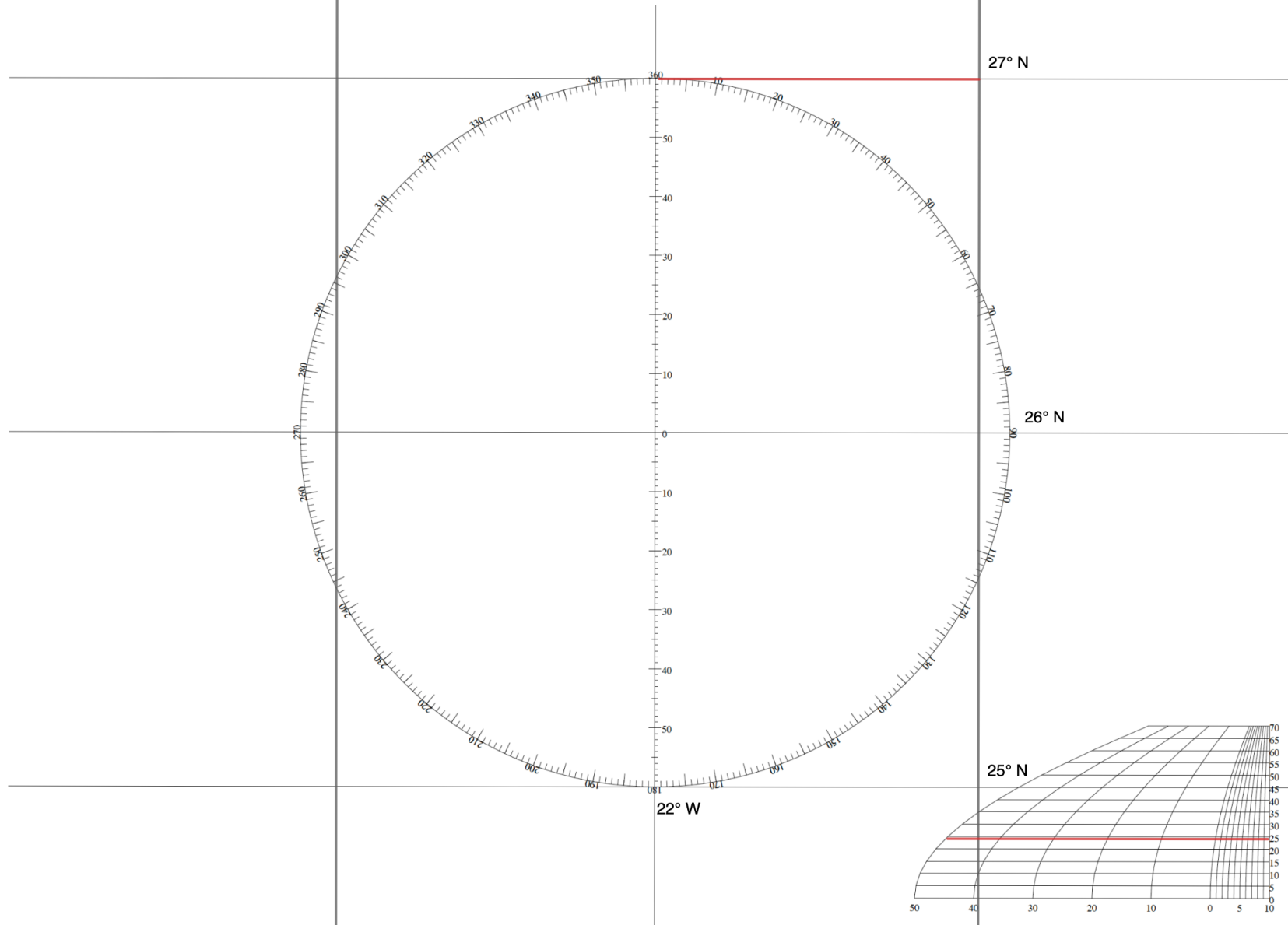


Plot time? Date: 13/2/2021

Page: _____

Plotting sheet





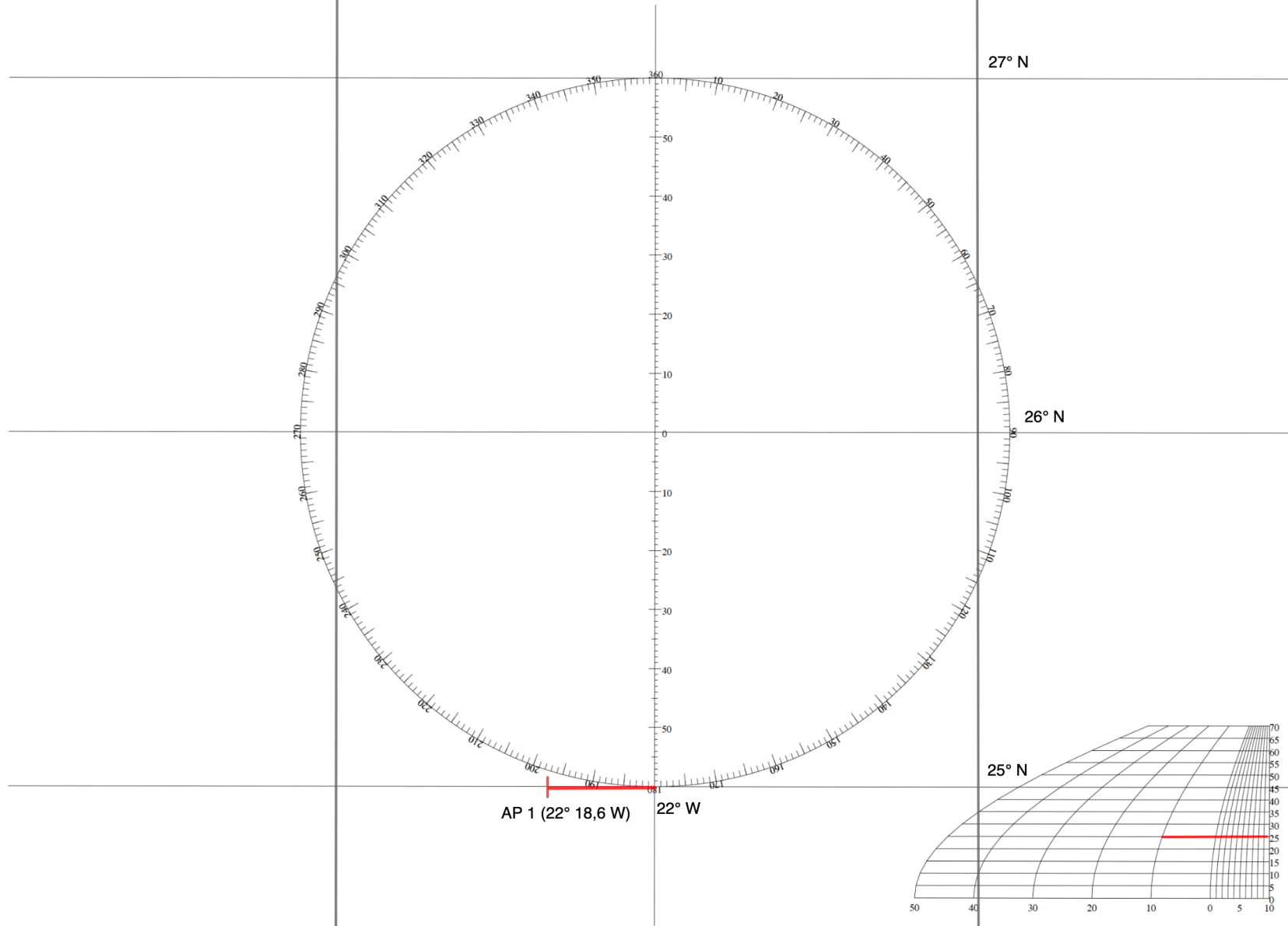
AP – Assumed position (zvolená pozice)

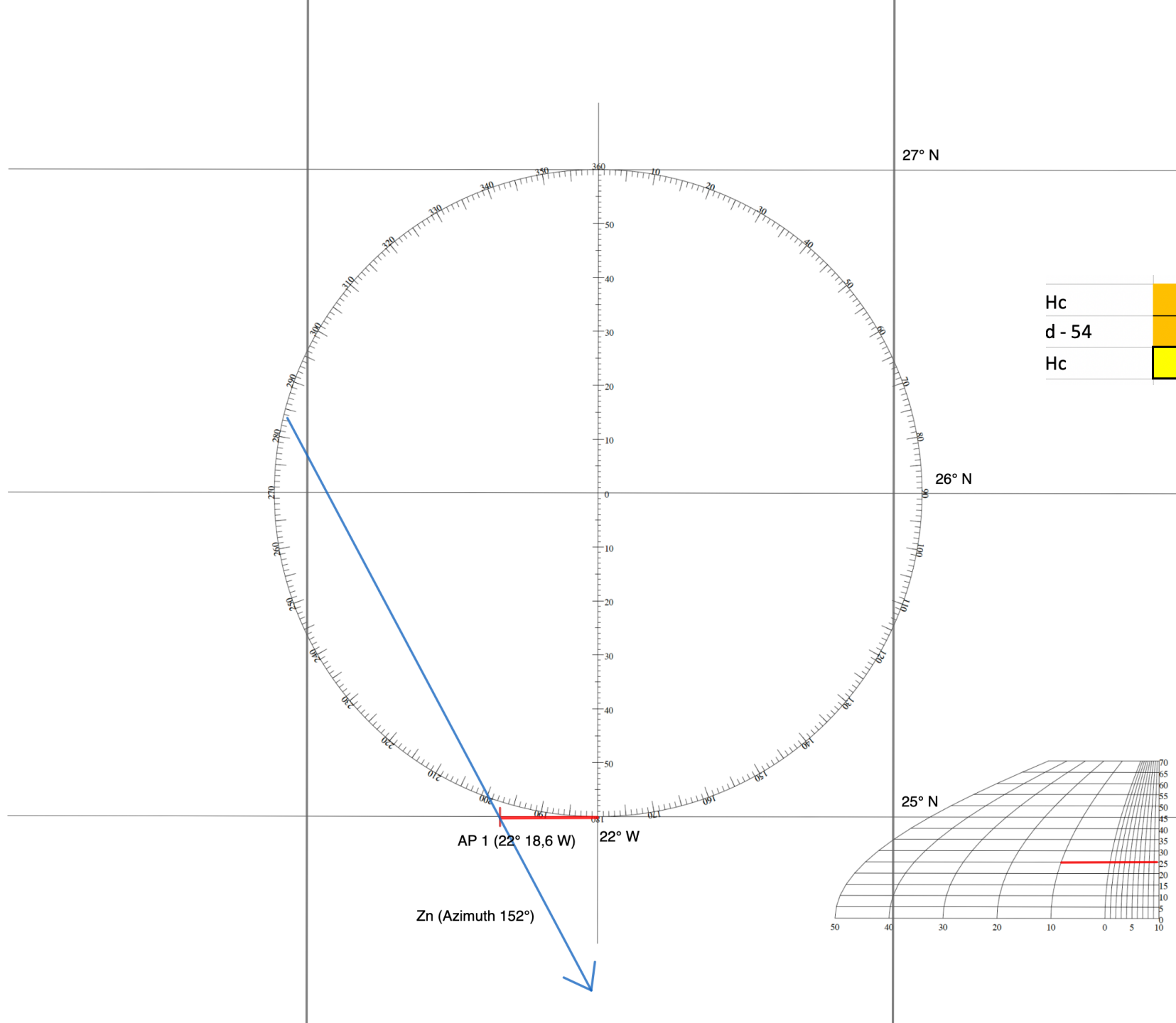
LHA je úhlová vzdálenost mezi long. mé pozice a GHA

LHA musí být celé číslo
LHA musí být kladné číslo

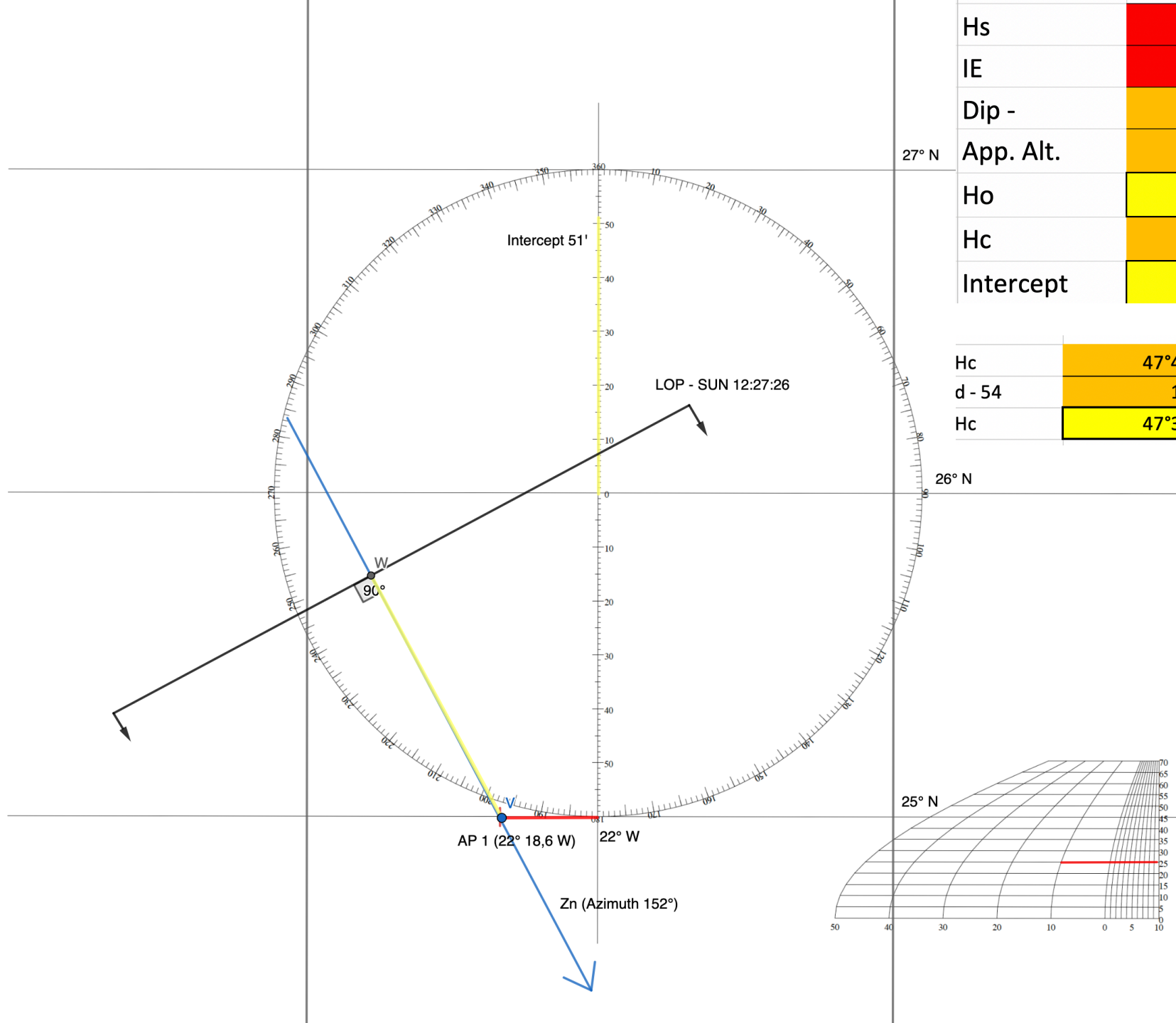
- $LHA = GHA \pm \text{long.}$
 - E long. přičítám
 - W long. odečítám
- AP zvolím tak, aby vyšlo celé číslo
- Vypočtu LHA

GHA	356°27,0'	
Incr (m/s)	6°51,5'	
GHA	003°18,5'	363°18,5' (+360)
AP Long	22°18,5'	W - / E +
LHA	341	celé číslo!!!



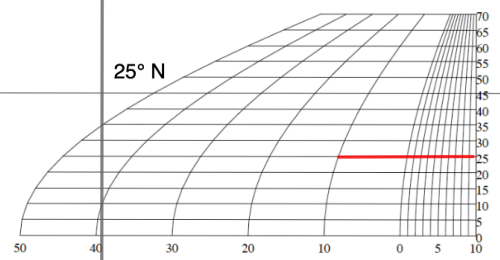


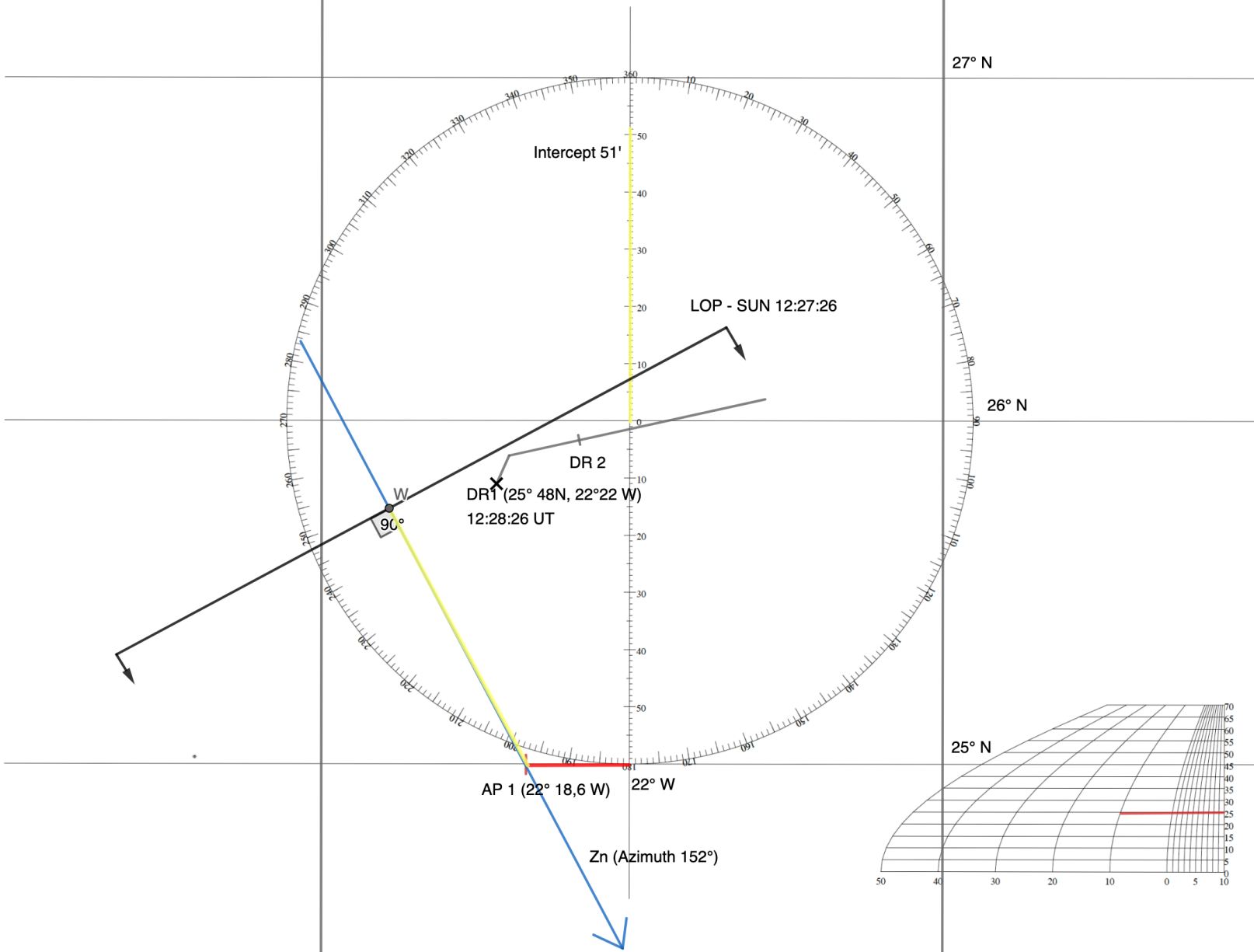
Hc	47°43' z	152°
d - 54	10' 180/360	LHA !
Hc	47°33' Zn	152°



Hs	46°26,8'	LL+
IE	-----	
Dip -	- 4,0	
App. Alt.	+15,3	O-M
Ho	46°42,1	
Hc	47°33'	
Intercept	51'	AWY

Hc	47°43' z	152°
d - 54	10'	180/360
Hc	47°33' Zn	152°

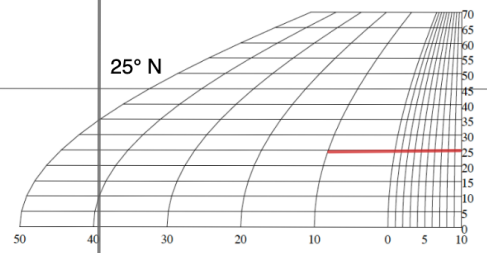


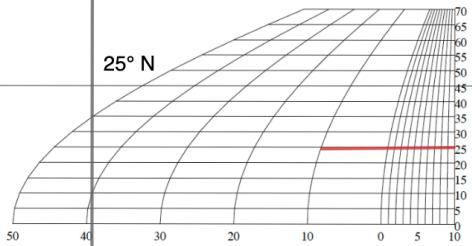
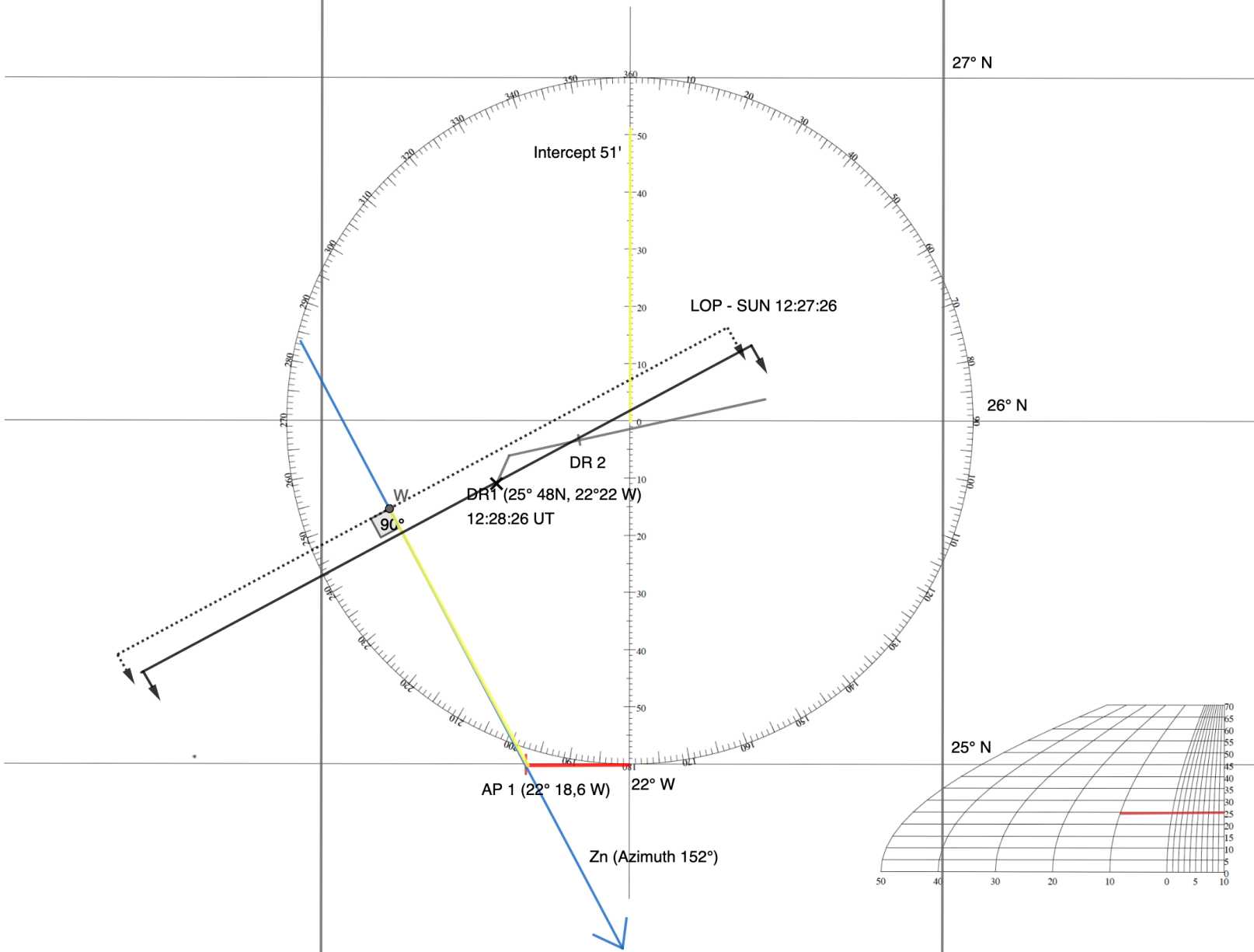


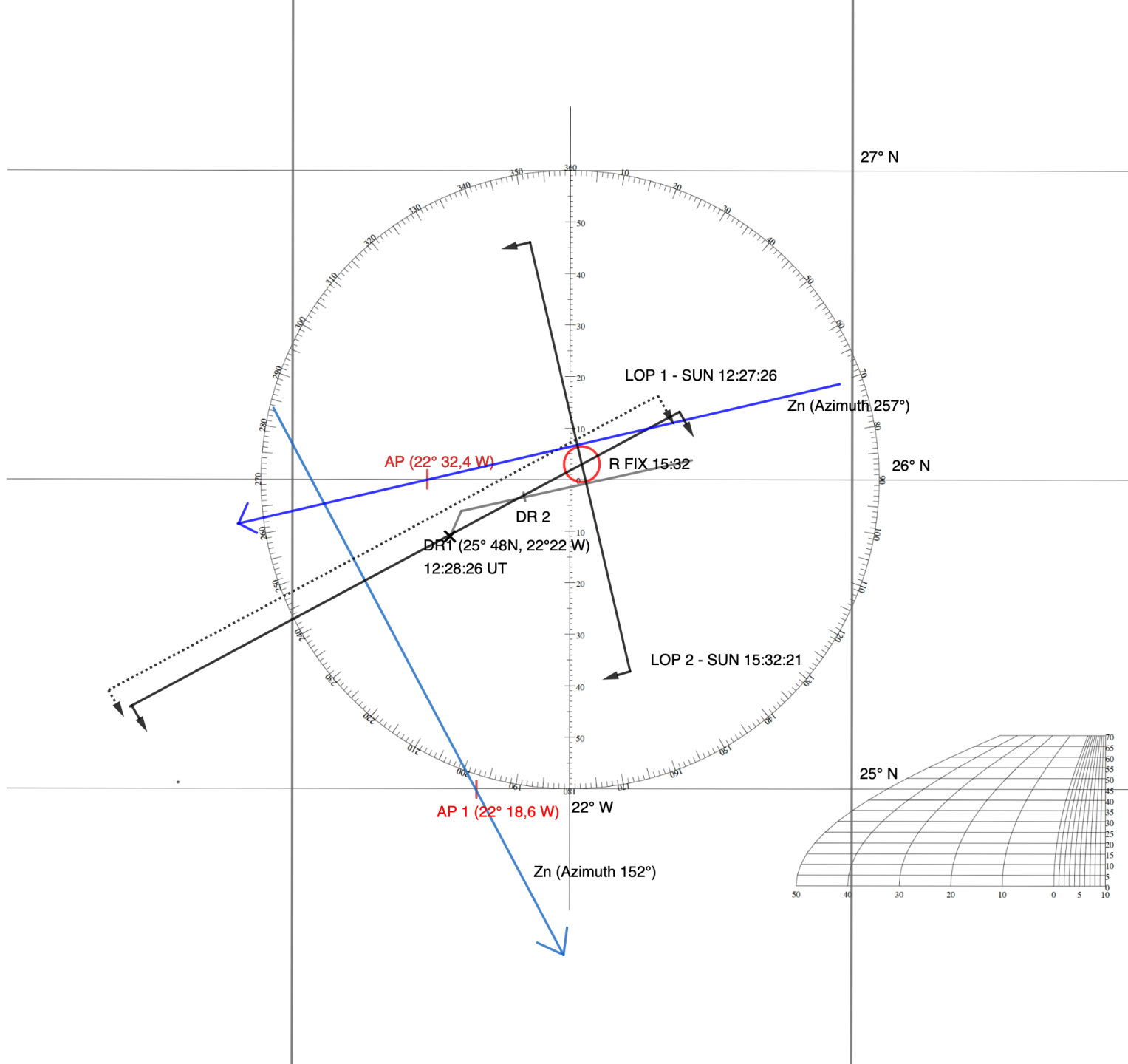
27° N

26° N

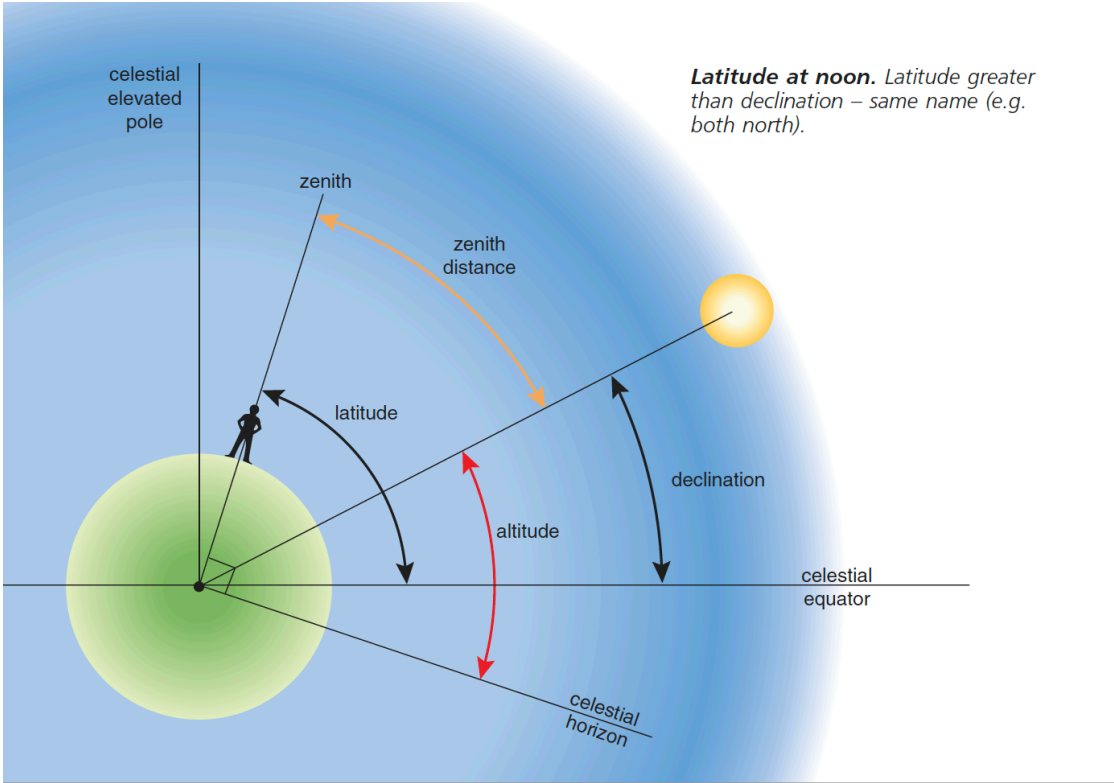
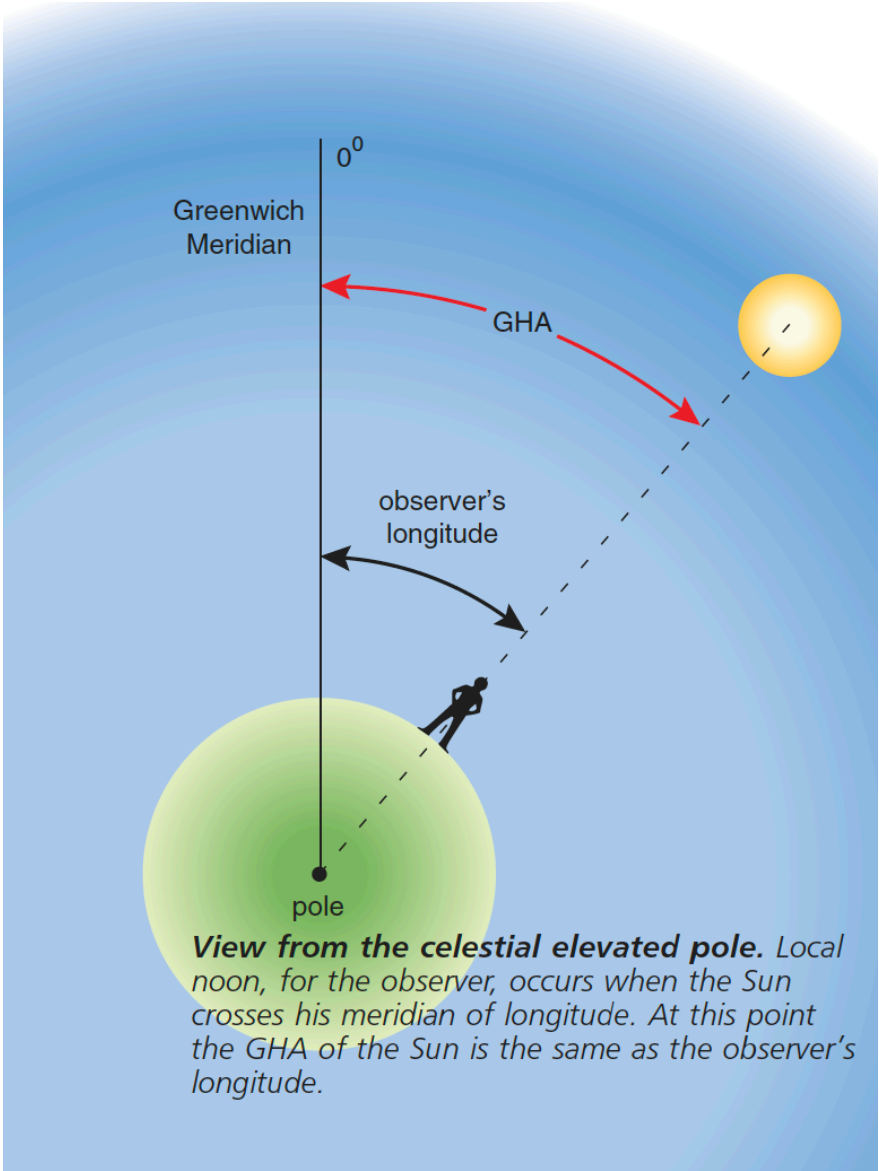
25° N



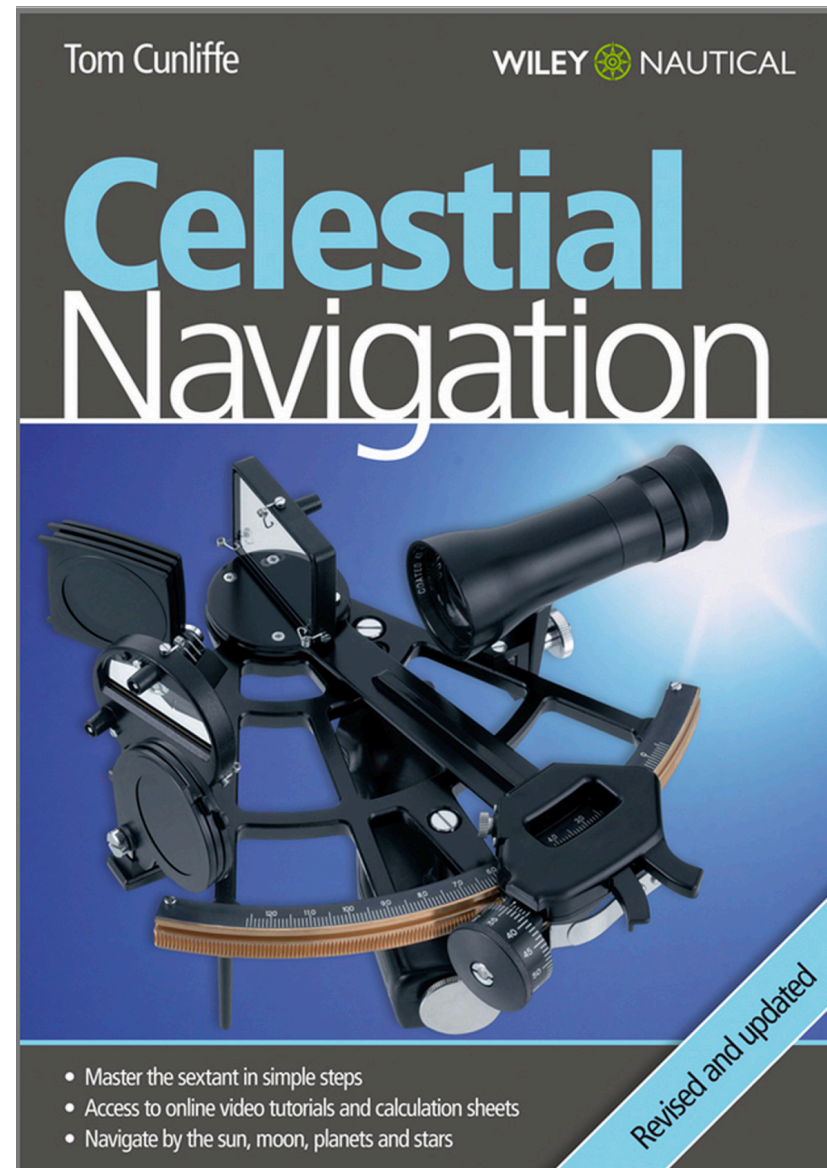




Noon sight – metoda pravého poledne



Zdroje pro
učení



<https://thenauticalalmanac.com/>

Webové
informace

The Nautical Almanac

The free online Nautical Almanac

The world's most complete source of free celestial navigation information



Děkuji vám za pozornost

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