

Confédération Mondiale des Activités Subaquatiques
World Underwater Federation



DIVE COMPUTERS
RECOMMENDATIONS

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PREFACE

Members from technical, scientific and medical commission co-operated to the writing of this document. We started with a document from the Belgian federation which has its own rules (law, insurance, US NAVY 1993 diving table, and so on ...)

That Belgian work was modified to be applied to CMAS.

We thank all the people who collaborated to this work.

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1. INTRODUCTION

- As time goes on, computers have become a tool each time more performing and more available. CMAS have followed this evolution with the greatest care. With this in mind, it initiated its study and elaborated this syllabus concerted and conceived:
- By searching the application of long lasting and acceptable rules.
 - * By adopting a pragmatic and “timeless” aspect
 - * By making it assimilatory by the whole of the certified divers.
 - * By creating the bare bones of a “Briefing” type course, which favours the pedagogical aspect.

2. DEFINITION - REMINDERS:

- The use of a computer is allowed in pleasure dive only. Pleasure dive means any dive, whether single or successive, which do not include, test dive, exercise, training for/or taking exams to obtain any kind of brevet.
- If the computer will always suggest a solution to any given problem, one does not have to take for granted that the solution is applicable. The computer controls a limited number of parameters only.
- Further more, one has to underline that more recent will the model be, more performing will be the management of the decompression.
- The fact of utilising the computer does not grant dispensation from a thorough knowledge of the decompression tables. The computer will by all means, prove to be an excellent “second” to the confirmed diver.

3. DESCRIPTION AND FUNCTIONING MODE

- The initialisation is made by various methods: automatic, manual, shock, or by air pressure. The best known today remains the one by humid contact (automatic).
- The mathematical model, i.e. the Haldannien’s type translated into a language that can be used by the computer, will integrate the time/depth information for each compartment and calculate at each instant, the theoretical nitrogen tension of each one of the model compartments. Comparing these tensions with the given values for the ascent criteria’s will permit the calculation of the decompression.
- The Read Only Memory contains the programme with the characteristics of the utilised compartments, their periods, the characteristics, the ascent criterion which are associated to them, etc. etc.
- The Read Access Memory deals with the information in real time and works with the microprocessor.
- The microprocessor is the calculator allowing the exploitation of the information to reach the result: the decompression information on the display (screen).
- Numerous computers do not yet record infractions perpetrated in diving should the ascent speed or decompression proceedings not have been respected. Although a loud signal will be heard, no time nor proceedings’ change will be suggested. On the other hand, the ultimate generation of computers tends to register the infractions perpetrated as well as the relative formation of bubbles. Usually they will suggest procedures in order to remedy these situations.
- Obviously by not being in contact with the body tissues, the computer or the model mathematically included in its memory will not suggest any 100% reliable procedure of decompression as it remains based on mathematical results.
- Some new computers have air pressure and temperature sensors enabling to increase or fine tuning the decompression procedure in case of breathlessness or low temperature. They will also indicate solutions in case of blow-up or of interruptions of deco-stops. As a whole, these proceedings are just as acceptable as the diving table’s procedures.

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4. ADVISE FOR UTILIZATION

a.- NOTICE :

- Reading the instructions requires a thorough and definite understanding of the language. It is of paramount importance that these are read in a language mastered by the user.
- While in use, one will make sure to adhere strictly to the conditions preconised by the manufacturer.

b.- PLANNING MODE:

- Single dives: enable the approximation of eventual deco stops before immersion (simulation) for a certain time and at a given depth.
- Successive dive: same + variation of the interval. The interesting point in this case lies on the “ successive ” made by divers who in the first dive would not have dived together. One can then determine a time as well as an accessible depth according to the parameters of the various computers, providing all of them are equipped with the planning function. In case of brake down, this mode may bring a solution (see further)

5. BRIEFING

a. COMPULSORY MATERIAL

- Watch : not all computers shows the hour (departure), in case of brake down, it may help you out of trouble.
- Tables : same + should one steps out of pleasure dive, one will have to refer to the decompression tables.
- Manometer : even if some computers give some simulated calculation of the consumption and of the availability of time according to the residual air quantity, we recommend however the utilisation of a classical manometer, to ease the various pressure controls and to avoid errors of interpretation or reading.

b.- INITIALISATION

- Check the starting process of the various models of the team. Even if most of them initialise automatically once in the water, it is advisable to initialise them manually to make sure on one hand, that they function properly, on the other for some models, to enable them to reach an accurate atmospheric pressure.

c.- DIVE PROFILE:

- Reminders of planning, stress the inverted profile’s dangers once again. In as much as possible reach without delay the maximal depth decided during the briefing and then avoid to dive any deeper.
- Proscribe the “borderline” utilisation which consists in ascending a few meters as soon as the computer shows a time without a deco-stop near 0 (no dec. time). This tendency increases considerably the ADD risk.
- Should one of the members in the group not possess a computer, the most severe decompressure profile will be adopted, the one established before diving and/or at the start of the ascent. The group will remain together and everyone will step out of the water at the same time.
- Should members in the group possess different types of computers, here again the most severe protocol will be adopted, the group will remain together and everyone will step out of the water at the same time.

d.- TO RESPECT THE ASCENT SPEED

- Of the visual and/or by sound ascent decided during the briefing.

e.- SAFETY DECO-STOP

- Even if the computer does not show a deco-stop for the dive made, follow the rules pertaining to the federation’s tables, but CMAS recommend a safety deco-stop of maximum 3' to 5' between 3mt and 6mt, should conditions be good.

f.- EFFORT

- In case of strain, break the dive immediately start an uninterrupted ascent at the prescribed speed (advertised), and effect the deco-stop eventually indicated and/or one safety deco-stop.

g.- COLD

- Even if some computers begin to integrate partially the factor “temperature” in their calculations, we recommend at this stage, in as much as possible with very low temperatures, to dive within the non decompression tables.

6. SPECIAL PROCEEDINGS

a.- BLOW-UP - INTERRUPTION OF DECO-STOPS

- Respect the indications and instructions supplied by the computer. If no indication (the manufacturer may not have kept these parameters in mind) apply your Federation's procedure for the decompression table's utilisation.

b.- WAVE ACTION

- Follow the computer indications as well but do never effect 3mt deco-stops below 6mt and follow the time given by the computer.

c.- COMPUTER BREAK DOWN

- Single dives without a deco-stop
 - * Go back to your Federation's decompression tables. The "successive" is authorised with this tables (see decompression tables rules and methods).
- Single dives with deco-stops
 - * If deco-stops have not been started, refer above. If deco-stops have been started, bring the indicated deco-stops to an end. The "successive" is prohibited (24H)
- Successive dive without a deco-stop
 - * In case of failure, break the dive immediately, ascent at the recommended speed, do the safety deco-stop should conditions prevail.
- Successive dive with deco-stops
 - * If the computer is equipped with the planning mode, as soon as the failure appears break the dive immediately, ascent at the prescribed speed and effect the known deco-stops.
 - * If the computer should not be equipped with the planning mode, as soon as the failure appears, break the dive immediately, ascent at 6mt at the prescribed speed and effect a maximum of deco-stops at this depth (not at 3mt).
N.B. : One shall note here again the advantage to have the planning mode.
 - * In the interval time, Prohibition to dive again within the next 24H as it is impossible to obtain parameters, allowing to calculate a successive.

d.- Flying after diving.

- Although the computer may say differently, always, await 24 hours prior to flying (DAN)

NB : it is important to have read the notice carefully in order to know whether the computer has forecasted these instances.

7. UTILISATION LIMITS

- Refer to your federation's rules and to computer manual re :
 - * depth limits
 - * limits of authorised daily dives
 - * resting time (without a dive) after several days of successive dives
 - * factors favouring the ADD
 - * etc.
- One can go from the tables to the computer or vice versa. However this cannot be done as one may wish, one has to be desaturated to pass from the tables to the computer while inversely one has to wait for the total time of desaturation shown by the computer be null.

8. CAREFUL, IF I CALCULATE THEM...I DO NOT GUARANTEE THEM!!!

- Intensive dive
- Yo-yo dives (lift)
- Strain while diving
- Excessive depths dive
- Extreme conditions (cold)
- Non respect of deco-stops
- BLOW-UP
- To catch. an early flight

9. TODAY'S IDEAL INSTRUMENT

- It should supply the followings:
 - * dive time
 - * maximal depth reached
 - * instantaneous depth
 - * detailed indications on deco-stops to be made: time and depth
 - * ascent speed with advertising either in % of a maximal speed, or in histogram
 - * intervals since out of the water
 - * to resolve the following problems: interruption of a deco-stop
Blow-up
 - * planning mode
 - * low-battery indication
 - * alarm when no respect of the instrument utilisation rules (i.e. blow-up, etc.)
 - * forecast altitude dives

10. SYNTHESSES

- The 10 golden rules for diving with a computer :
 1. Read and understand the instructions notice - read it again occasionally
 2. Do not take everything for granted, respect strictly the manufacturer and your Federation's rules
 3. Make sure of the good functioning of your instrument prior to putting it in the water
 4. Remain as near as possible of the "ideal" profile and of the utilization rules
 5. Avoid the yo-yo dives, border line, hybrid
 6. The computer is an individual and personal instrument
 7. Do not use a computer saturated by someone else
 8. Plan your dive and stick to your planning
 9. Refer to the most severe decompression mode and remain grouped within the dive team
 10. Remains a dive profile which offers a solution in case of break down
- In no case, these 10 rules prevent:
 1. A thorough knowledge of the decompression tables
 2. A diving experience
 3. To limit the depth as per the rules of your federation
 4. To respect a day of rest every 5 days in case of intensive diving
 5. To effect the deepest depth first
 6. Not to put oneself in a situation of exception
 7. To avoid close successive dives.

11. CONCLUSIONS

- *The diver's experience remains the first quality of a group leader and not the ownership of a computer, one can never trust blindly this instrument, it can be perfectible, your experience and your knowledge of the decompression tables could enable you to detect an eventual anomaly in its function.*
- *As a "second" in diving the computer is a definite "plus". It is certainly not the panacea and does not prevent in any way the thorough learning of the "tables".*
- *It is the perfect instrument for experienced divers. One does not give precision instruments to beginners.*

12. CONSULTED BOOKS

- aladin pro
- aladin air X (gestion d'air)+ fascicule "a new calculation model for the aladin air x diving computer" + fascicule "aladin air x personal decompression companion"
- suunto eon (gestion d'air)
- suunto alpha
- suunto solutions
- monitor 2
- monitor 3 (gestion d'air)
- dc 11
- dc 12
- trak (gestion d'air)
- maestro pro ean (gestion d'air)
- bravo one
- scan 4 (gestion d'air)
- datamax sport
- datamax pro (gestion d'air)
- source
- dacor omni pro (gestion d'air)
- dive mate mares
- genius mares (gestion d'air)
- USNAVY DIVING MANUAL 1988-1993-1995-1996
- USNAVY DIVING TECHNICAL MANUAL 1983
- DECOMPRESSION THEORY DIVE TABLES and Dive Computer J.E. LEWIS 1990
- DIVE COMPUTER HISTORY,THEORY AND PERFORMANCE K.LOST 1991
- PLONGER AUX MELANGES H.JUVENSPAN C.THOMAS 1992
- L'ordinateur de plongée P. Bourdelet et A. Fuchs
- NEDU REPORTS 80 à 85
- DECOMPRESSION AND COMPUTER ASSISTED DIVING Bob COLE
- INTERNET "Abyss advanced dive planning software" - "Aquanaut" - "IDCR-internet dive computer review" - "South africa charybdis" - " Nitrox //zeus.bris.ac.uk "
- DEEP DIVING bret Gilliam
- CMAS Conférence "Dive computers"
- Scientific Diving Supervisory Committee : technical memorandum nr 2, March 92, published by NERC