



CASUARINA DIVE PLANNER

Technical-diving software

Casuarina Dive Planner™ (CDP) software is a product of Casuarina Aquatics, Inc.™ (CAI). It is intended to be used for dive planning by properly certified divers or for training of appropriately trained divers by properly certified instructors. Hence a wide range of divers can utilize it. CDP can be used for planning non-decompression dives within standard sport-diving limits by "recreational" divers; it can be used by divemasters and specialty divers to develop understanding of inert-gas dynamics and established models for DCS and oxygen-related phenomena; and it can be used by "technical" divers for planning multi-level, mixed-gas dives.

Casuarina Dive Planner uses well-established, validated algorithms for all calculations, and has a user-friendly interface that provides easy text inputs, point-and-click selections, and simple text and graphical outputs.

OVERVIEW of *CDP*

CDP is a sophisticated program intended to help properly trained divers plan dives across a broad spectrum of diving rigor – including decompression and mixed-gas dives – gain insight into diving physiology, and develop an improved understanding of the reasons behind good diving practice (e.g., prudent bottom times, slow ascents, mixed-gas use, decompression profiles, etc.). Naturally, *CDP* must be used in a manner that is consistent with the diver’s level of training and certification, and in most cases, it will be of greater interest and value to the more-advanced diver – particularly the technical diver – but as long as it is used in a manner consistent with a diver’s training and certification, it can serve a variety of diver needs. Beginners can gain insight into gas-related phenomena underlying their dive tables and planners, while more-advanced divers can develop safe profiles for extreme decompression diving that takes into account gas consumption, oxygen effects, and narcosis risks while allowing the individual diver to apply conservatism in a variety of ways and iteratively to develop an optimal plan that satisfies that diver’s needs and constraints.

One of *CDP*’s most significant features is its simple, easy-to-use graphical user interface (GUI) that presents all important information on a single main screen supplemented by auxiliary displays on separate screens. On high-resolution displays, all screens can be viewed simultaneously. On low-resolution displays, auxiliary screens can be displayed at any time by clicking on a menu, an icon, or a task-bar entry.

CDP provides the diver with standard defaults for many variables, such as gas composition (air), altitude (sea level), water type (salt), etc. The diver can begin planning by entering non-default values, initializing *CDP*, then entering waypoint information, i.e., depth and runtime, for each step in the dive. *CDP* then returns outputs of a variety of kinds for the latest waypoint based on the entire dive profile up to the waypoint, and tracks all waypoints in a plot of depth and ceilings vs. time and in a text file that can be used subsequently to document and execute the selected dive plan. *CDP* also allows a default combination of gas mixtures and several standard mixtures (such as air and EANx mixtures) to be used for automatic decompression planning. The user can input any combination of custom decompression mixes and can save each of them for future use.

The algorithms underlying *CDP*’s computations, its inputs and its outputs are described in the detailed User’s Manual, which is available on the Casuarina website. This Manual will enable you to use *CDP* in with ease; the sections after a “quick-start” introduction section describe the use of *CDP* in sufficient depth to make its use straightforward and productive. Questions on the use of *CDP* that remain after you read the Manual can be submitted to *CAI* by e-mail, fax, or postal mail.

support@casuarina-aquatics.com
<http://www.casuarina-aquatics.com>

Casuarina Aquatics, Inc.
P.O. Box 805
Rye, NY 10580-0805
914-967-5778

Selected Key CDP Inputs and Outputs

CDP's inputs include:

- Waypoint time (mandatory for every step of the profile except automatic deco steps)
- Waypoint depth (mandatory for every step of the profile except automatic deco steps)
- Degree of conservatism
- Oxygen concentration (up to 100%)
- Helium concentration
- Surface air-consumption rate
- Altitude at the surface (before, during or after the dive)
- Feet of water for a pressure change of 1 atmosphere
- Surface gradient factor
- Deep gradient factor
- Depth of deep gradient factor
- Gas-content bar graph scale
- Profile depth scale maximum (starting)
- Profile time scale maximum (starting)
- Alternative deco mixes, depths, and surface air-consumption rates (savable)
- Alternative compartment half lives, slopes, and intercepts (currently not savable)

All inputs are loaded with default values; the user must enter all waypoint times and depths for descent and bottom portions of the dive profile. *CDP* can automatically compute ascent times and depths for dives that require stage decompression; however, manual entries are optional.

CDP's outputs include:

- Graphical display of depth, fractional ceiling and absolute ceiling vs. depth
- Graphical display of gas content, fractional M-value and maximum M-value in each compartment
- Absolute and fractional ceilings and limiting compartment for each
- Risk factors associated with proximity to absolute and fractional M-values and the limiting compartment for each
- Tabular display of M-value and nitrogen, helium and total pressure in each compartment
- Surface pressure (computed from altitude and can apply to flying after diving)
- Nitrogen concentration
- Partial pressures of all gases
- Equivalent air and narcosis depths (assuming oxygen and nitrogen are equally narcotic)
- Maximum depths for oxygen partial pressures of 1.4 and 1.6 atmospheres
- CNS exposure and accumulated OTUs
- Best oxygen concentration for the current depth
- Volume of gas used (up to 13 different mixes) per dive
- Separate, editable text file that lists dive number, waypoint (step) number, depth, run time, deco stop times, mix number, mix used, mix gas concentrations, oxygen partial pressure, accumulated percent of CNS exposure, and accumulated OTUs at every waypoint

Some key features of *CDP* include:

- Infinite number of dives and surface intervals
- Pre-dive oxygen breathing
- Flying before or after diving
- Diving at altitudes above sea level
- Diving in media with densities other than salt water
- Option for using mix inert gases other than helium and nitrogen
- Option for saving custom inert-gas half times, etc., e.g., for gases other than helium and nitrogen (free future update for registered users)

SAMPLE OUTPUTS

Some sample outputs from actual *CDP* runs are shown below. These outputs are generated at every waypoint in the dive. Only the surfacing displays for the end of the dive are shown.

CDP 21 -- Advanced technical multipurpose dive training and planning software

File Mixes Conservatism Ascent View Help

COMPUTE REINITIAL EXIT

DIVE / STEP 1/6
RUN TIME 22
DEPTH 0
RATE -8
 Conservatism #: 1 2 3 4 5

Oxygen Concentration 0.21
 Helium Concentration 0.00
 SAC (surface) Rate 0.50
 Surface Altitude 0
 Feet per Atmosphere 33.0
 Save File Name Profile.txt

Surface Gradient Factor 0.70
 Deep Gradient Factor 0.30
 Gradient-Factor Depth 300
 Gas Bar-graph Scale 1.00
 Maximum Depth Scale 150
 Maximum Time Scale 100

Surface Pressure 1.00
 Nitrogen Concentration 0.79
 Ambient Pressure 1.00
 O2 Partial Pressure 0.21
 He Partial Pressure 0.00
 N2 Partial Pressure 0.79
 Equivalent-air Depth 0.0
 Equivalent-narcosis Depth N/A
 Max Depth (PO2 = 1.4) 187.0
 Max Depth (PO2 = 1.6) 218.4
 % CNS O2 limit 4.1
 OTU accumulation 12.2
 Best O2 concentration 0.80

Mix 1 Used 36.7

DECO-DIVE CEILINGS

	Depth	Compartment
Absolute Ceiling Factors	0	0
Fractional Ceiling Factors	0	0

DCS RISK FACTORS

	Risk	Compartment
Absolute Risk Factors	0.68	3
Fractional Risk Factors	0.98	3

BOTTOM TIME do calc
 Bottom Time Left infinite

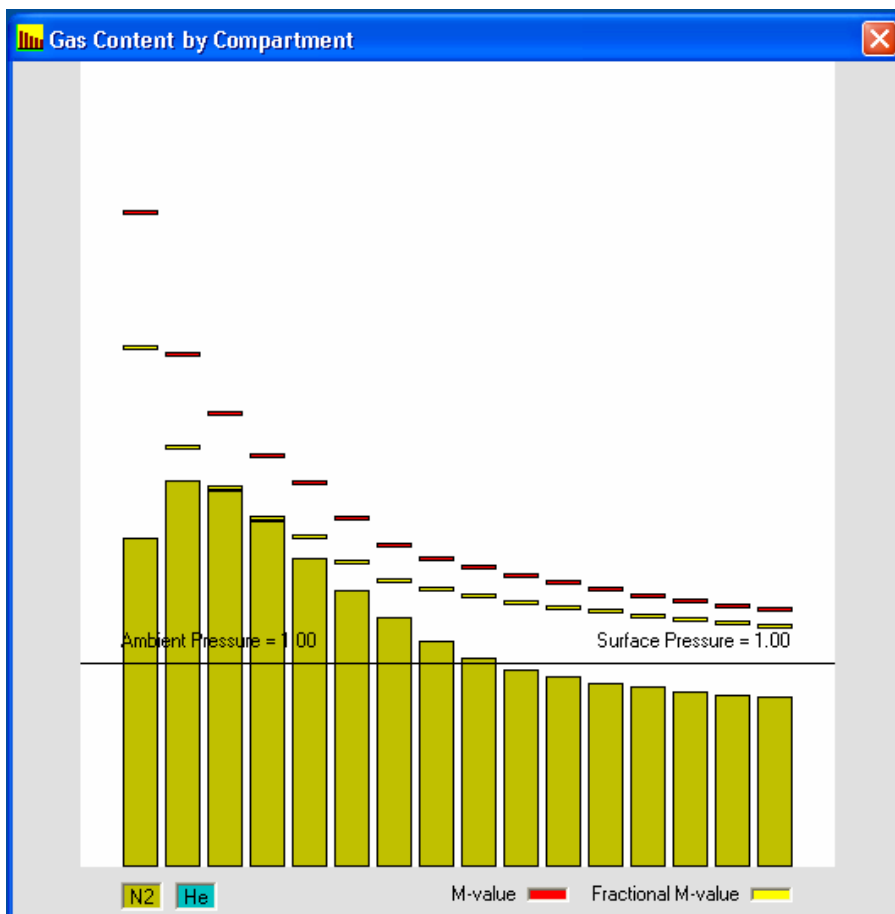
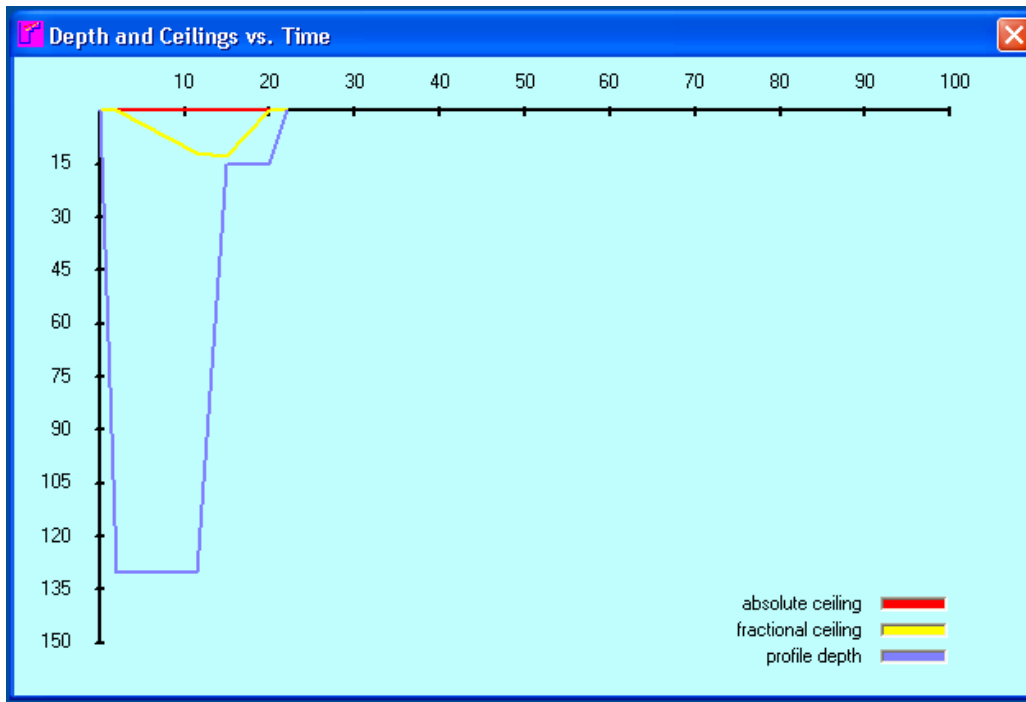
STOP PARAMETERS

Stop Time Left no deco
 Next Stop Depth no deco
 [Depths are multiples of 10'.]

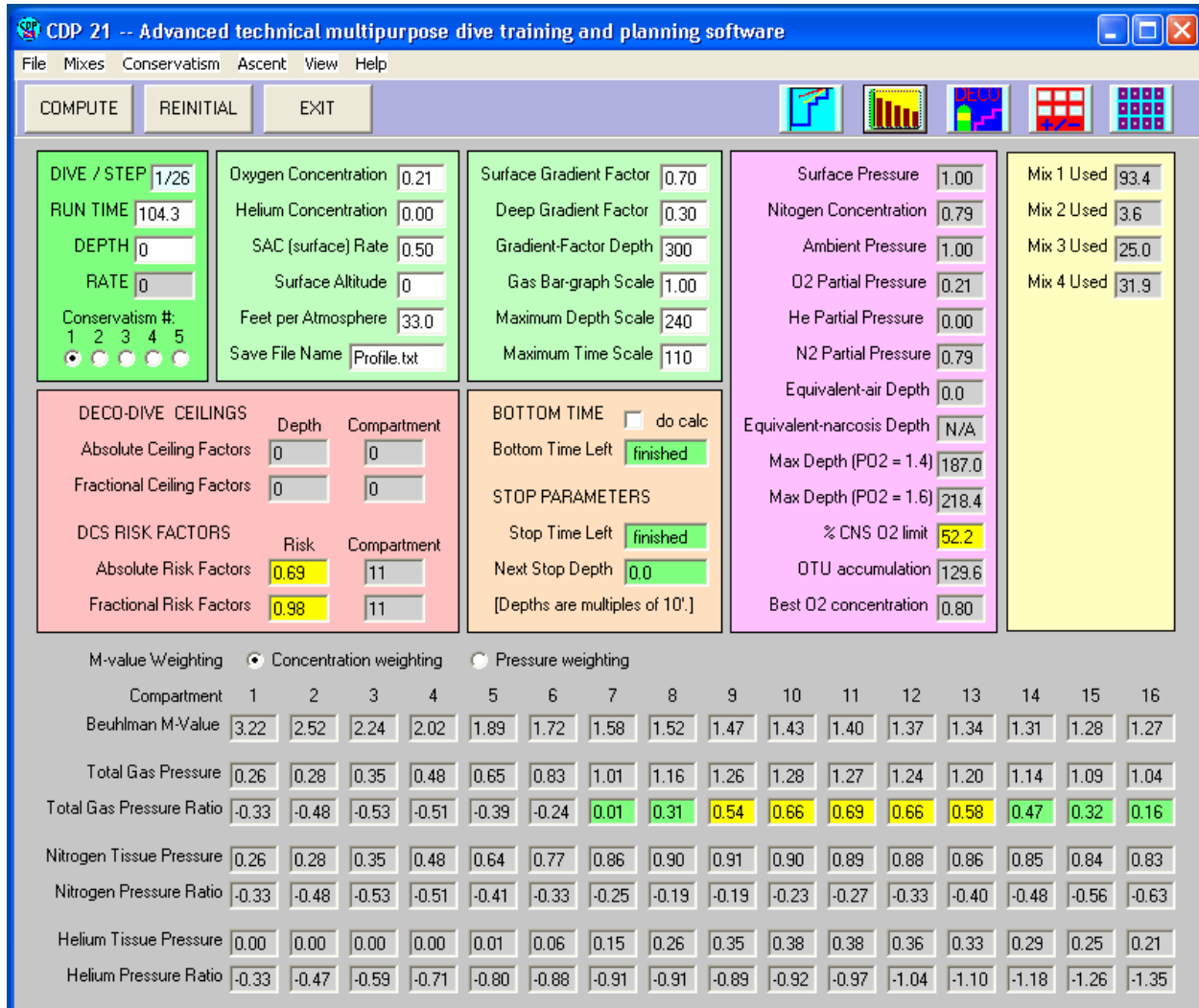
M-value Weighting Concentration weighting Pressure weighting

Compartment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Beuhlman M-Value	3.22	2.52	2.24	2.02	1.89	1.72	1.58	1.52	1.47	1.43	1.40	1.37	1.34	1.31	1.28	1.27
Total Gas Pressure	1.61	1.90	1.85	1.70	1.52	1.36	1.22	1.11	1.03	0.97	0.93	0.90	0.88	0.86	0.85	0.83
Total Gas Pressure Ratio	0.28	0.59	0.68	0.68	0.58	0.50	0.38	0.22	0.06	-0.07	-0.17	-0.26	-0.36	-0.46	-0.54	-0.62
Nitrogen Tissue Pressure	1.61	1.90	1.85	1.70	1.52	1.36	1.22	1.11	1.03	0.97	0.93	0.90	0.88	0.86	0.85	0.83
Nitrogen Pressure Ratio	0.28	0.59	0.68	0.68	0.58	0.50	0.38	0.22	0.06	-0.07	-0.17	-0.26	-0.36	-0.46	-0.54	-0.62
Helium Tissue Pressure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Helium Pressure Ratio	-0.33	-0.47	-0.59	-0.71	-0.81	-0.94	-1.07	-1.23	-1.37	-1.49	-1.57	-1.63	-1.64	-1.67	-1.68	-1.71

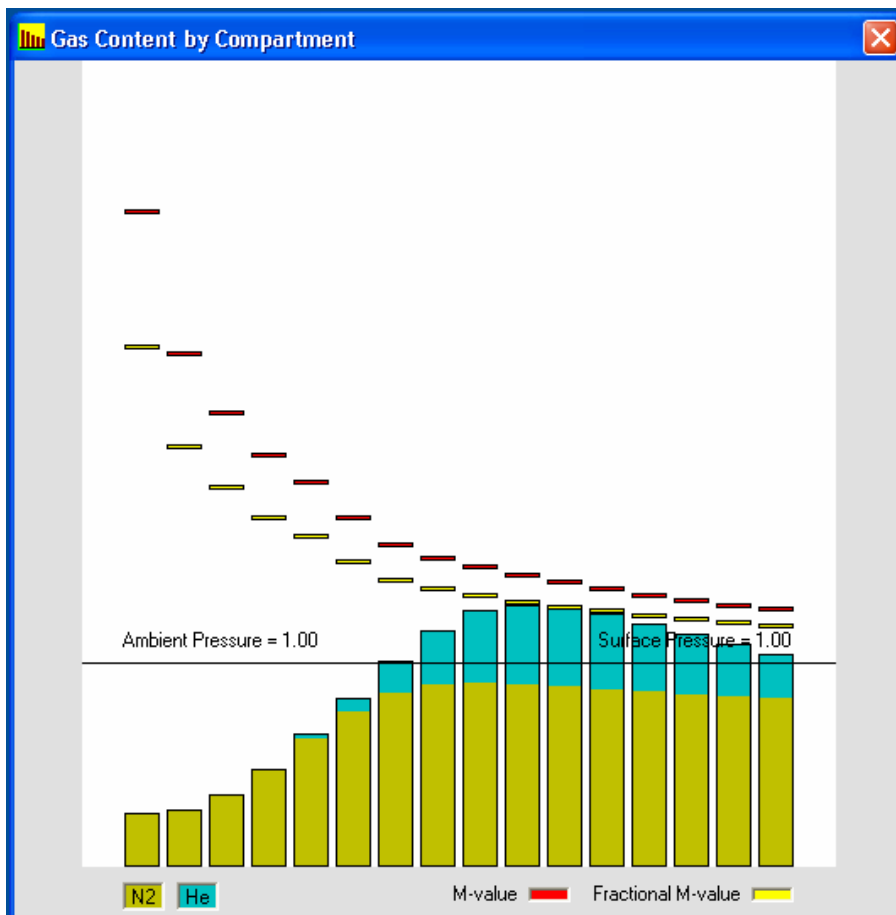
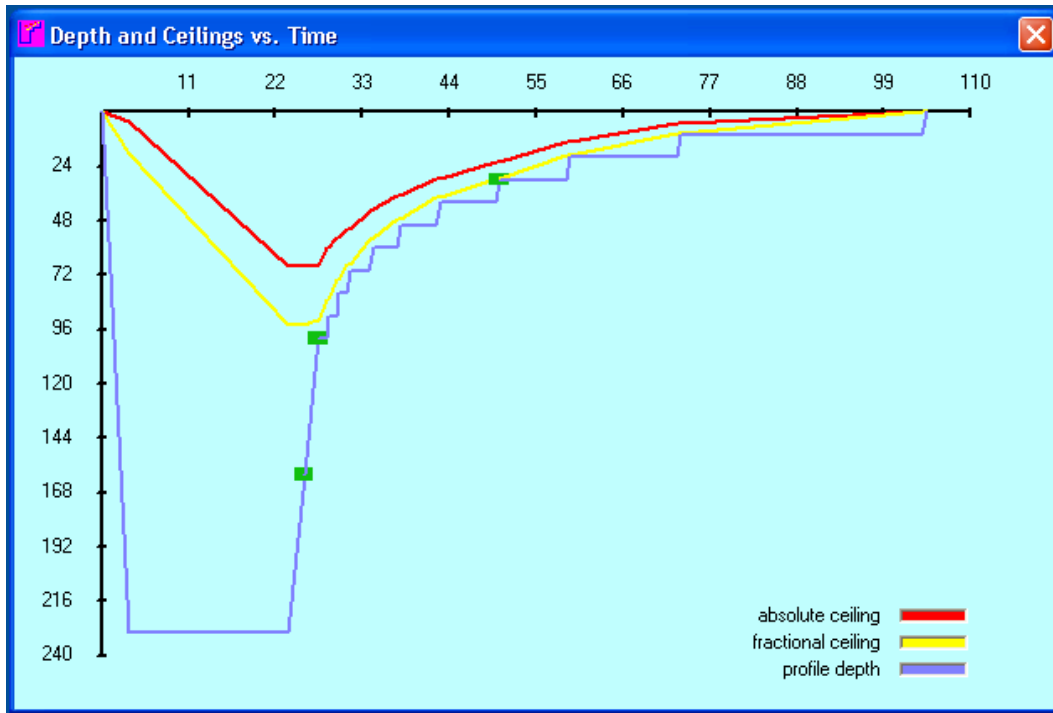
Sample GUI for a 130-foot dive using air: The surfacing values are shown. Note that the dive consumed 36.7 cubic feet of air assuming a surface air consumption rate of 0.5 cubic feet per minute, and the ascent rate and safety stops chosen left the diver with risk factors below 1.0 for DCS. Only 4.1% of the exposure limit for oxygen CNS toxicity was utilized.



Sample profile and gas content by compartment for the 130-foot dive shown above: Note the safety stop and slow ascent to the surface after the stop. Also note how the gas content in each compartment approaches, but does not exceed, the limits imposed by the fractional M-values at the end of the dive.



Sample GUI for a 230-foot dive using 17/50 trimix: The surfacing values are shown. Note that the dive consumed 93.4 cubic feet of trimix assuming a surface air consumption rate of 0.5 cubic feet per minute for the traveling and bottom segments and 0.4 cubic feet per minute on the ascent. Default ascent mixes were used. (Mixes and other dive parameters are shown in the text file below.) Over 50% of the exposure limit for oxygen CNS toxicity was utilized.



Sample profile and gas content by compartment for the 230-foot dive shown above: Note that gas-change deco stops are indicated by green cursors on the profile. Also note how the sum of the helium and nitrogen content in each compartment approaches but does not exceed the limits imposed by the fractional M-values at the end of the dive.

28-Apr-2002 01:29 PM

DIVE/STEP	DEPTH	RUN TIME	STOP TIME	MIX NUMB	MIX USED	CONC O2	CONC HE	PPRES O2	CNS %	OTU
start of new dive										
1/1	230	3.5		1	7.8	0.17	0.50	1.35	2.2	2.2
1/2	230	23.5		1	87.5	0.17	0.50	1.35	14.6	33.4
deco ascent started at 230 feet										
1/3	160	25.6		1	93.4	0.17	0.50	0.99	15.3	36.1
mix changed at 160 feet										
1/4	130	26.5		2	2.0	0.21	0.00	1.04	15.6	37.2
1/5	100	27.4		2	3.6	0.21	0.00	0.85	15.8	38.0
mix changed at 100 feet										
1/6	100	28.4	1.0	3	1.6	0.36	0.00	1.45	16.6	39.7
1/7	90	28.7		3	2.1	0.36	0.00	1.34	16.8	40.2
1/8	90	29.7	1.0	3	3.6	0.36	0.00	1.34	17.4	41.8
1/9	80	30.0		3	4.0	0.36	0.00	1.23	17.5	42.2
1/10	80	31.0	1.0	3	5.4	0.36	0.00	1.23	18.0	43.6
1/11	70	31.3		3	5.8	0.36	0.00	1.12	18.2	44.0
1/12	70	33.8	2.5	3	8.9	0.36	0.00	1.12	19.3	47.0
1/13	60	34.3		3	9.5	0.36	0.00	1.01	19.4	47.5
1/14	60	37.3	3.0	3	12.9	0.36	0.00	1.01	20.5	50.6
1/15	50	37.8		3	13.4	0.36	0.00	0.91	20.6	51.1
1/16	50	42.3	4.5	3	18.0	0.36	0.00	0.91	21.9	54.9
1/17	40	42.8		3	18.4	0.36	0.00	0.80	22.0	55.2
1/18	40	49.8	7.0	3	24.6	0.36	0.00	0.80	23.6	59.8
1/19	30	50.3		3	25.0	0.36	0.00	0.69	23.7	60.0
mix changed at 30 feet										
1/20	30	58.8	8.5	4	6.5	0.80	0.00	1.53	32.5	75.5
1/21	20	59.3		4	6.8	0.80	0.00	1.28	32.8	76.3
1/22	20	72.8	13.5	4	15.5	0.80	0.00	1.28	40.3	95.9
1/23	10	73.3		4	15.8	0.80	0.00	1.04	40.5	96.6
1/24	10	103.8	30.5	4	31.7	0.80	0.00	1.04	52.1	129.2
1/25	0	104.3		4	31.9	0.80	0.00	0.80	52.2	129.6

Sample editable output text file for the 230-foot trimix dive shown above: The text file of the dive profile can be edited to include comments regarding the dive, etc. The sample above was not edited at all so that the basic output format could be displayed. Times are given as total run times to each step (waypoint) and also as discrete decompression-stop times, which do not include the ascent time between stops. Gas-loading calculations include ascent times as well as stop times. Note that each dive step number is preceded by the number “1” to indicate this is the first dive in a series. CDP allows an unlimited number of dives and altitude changes to occur. CDP also allows for pre-dive acclimatization at altitude and pre-dive nitrogen-tension reduction by breathing gas mixtures with elevated oxygen concentrations prior to the dive.

TRY CDP FREE !!!!

A fully functional copy of **CDP** is available for interested divers to try for 30 days without charge. You can request your copy by contacting

sales@casuarina-aquatics.com

You also can download the **CDP** User’s Manual at no charge from the Casuarina Aquatics web site.

<http://www.casuarina-aquatics.com>

The current manual uses some examples from earlier versions of **CDP**, but these examples differ only in small cosmetic details.