FORMATION OF CAVES

I. N.A.C.D. Course orientation and objectives.

A. What is N.A.C.D.

B. Phases of diving N.A.C.D. is involved with.

C. Training standards, requirements for N.A.C.D. and full certification.

D. Ultimate goal is "safe cave diving."

II. Formation of Caves.

A. General types v/w caves (4) as listed:
Sea, Coral, Lava, Solution.

B. Origin of solution caves.

1. Solution

2. Limestone, dolomite, gypsum

3. Folding/fracturing

4. Faults, good site for cave formation

5. Bedding planes

6. Breakdown

C. Role of water support (42%).

D. Aquifer.

1. Water table

2. Pizeometric level

3. Hydrostatic pressure

E. Types solution caves (5 types).

1. Springs - 4 parts: cave, outlet, headpool, run.

2. Characteristics (common)

3. 5 types of springs.

(a) Characteristics of each

4. Outflow measurements.

(a) 1st. magnitude 64.6 m.g.d. or 100 $ft.^3$ /sec.

5. Springs - syphons
   (a) Two types of spring syphons
   (b) 8 parts of one type.
      (1.) Explanation with diagram supplement
      (2.) Example of Peacock
   (c) 6 parts of other type
      (1) Explanation with diagram supplement
      (2) Example of Hornsby
   (d) Underground river
   (e) Formation of sink holes
      (1) Causes
      (2) Fast Formation

F. Parts of a sink (3)

G. Underground Lake
   1. Parts of(Lost Sea.).
   2. Diagram

H. Natural bridges - overhangs - undercuts

I. Natural hazards.
   1. General hazards
   2. Specific Hazards
   3. Limiting factors for visibility (4)
   4. H_2S
   5. Discussion and feelings of candidates on hazards

J. Silt
   1. 3 types of silt
   2. Greatest specific natural hazard
   3. Algae

K. Current as a natural hazard.

1. 4 types to consider.

2. Evaluation of:

L. Physical peculiarities as a natural hazard.

1. 5 peculiarities.

2. What effect these have.

M. Restrictions.

1. Two types.

2. General Discussion.

HISTORY OF CAVE DIVING

I. Dry cave explorations.

A. As shelter.

B. As adventure.

C. Role of sumps (stop point).

D. Diatram and explanation of a "sump".

II. First cave dive in 1773, at the siphon of Buxton water

B. First successful.

1. Details.

2. Findings in the grotto.

C. Ottonelli's dive.

1. Details

D. Penelope Powell's Dive.

1. First female

2. Details.

E. First U.S. Cave Dive.

1. Details

F. British cave diving group formed in 1946.

LIFE FUPPORT SYSTEMS

I. Equipment that compiles a safe life support system for cave diving.

A. Logical thinking diver.

B. Air Supply.

C. Regulators

D. Knife.

E. Lights.

F. Reel.

G. Buoyancy compensator.

H. Protective clothing.

I. Slate, depth guage, watch, dive tables.

J. Comasss, clothes pins.

K. Mask, fins, C.P.G.

II. Air supply - desirable and undesirable.

A. Minimum of double 71.2 $ft.^3$ tanks.

B. Benjamen valve.

C. Dual outlet valve.

D. Ideal manifold.

E. 2 complete separate systems.

F. Permanent manifold.

G. Temporary yoke.

III. Regulators.

A. Should have high volume and low resistance.

B. Must be at minimum an octopus.

C. Quadrapus.

D. Extra 2nd. stage.

E. Buddy tank, or pony bottle vs. octopus.

F. Must be single hose.

G. First S.C.U.B.A. cave dive.

1. Details

H. Wookey Hole Cavern exploration bldg.

1. Details.

I. Cousteau's assualt at Vacluse.

1. Details.

J. First S.C.U.B.A. cave dive in U.S.

1. Details

K. Blue Hole diving - G.J. Benjamen 1958.

1. Lusca

L. Blue Hole diving - G.J. Benjamen, W.T. Mount, 1970.

1. Stalactite, stalagmite formations found.

2. Importance of the find.

M. Preserved brain matter found.

1. Details.

N. D.A. Desautels diving in North Florida.

1. First recovery group.

O. Deaths. (first)

1. Henri Lombardi in France, Oct. 8, 1950.

2. First U.S. fatality - Murray Anderson, 1955.

3. Details.

P. Four U.G.A. students die in Jenny.

1. Details.

Q. Frank Martz & Randy Hilton's Deaths.

1. Details on both drownings.

R. Formation of N.A.C.D.

1. Details.

S. First "Traverse".

1. Details.

G. Required maintenance.

IV. Knife

A. What used for.

B. Ideal characteristics.

C. How and where carried.

V. Lights (main).

A. Water and pressure proof,etc.

B. Frank Martz (designer)

C. Different power sources.

D. 20 - 100 watt ratings.

E. Requirements of main lights.

F. Most desirable main lights.

G. Costs of main lights.

H. Desirability of wet wi-cad systems.

I. Required maintenance.

VI. Lights (backup)

A. Must be ultra-dependable.

B. Different types.

C. Desirable characteristics.

D. How powered.

E. Proper selection.

F. Use and storage of main and back up lights.

G. List of all desirable back up lights, characteristics (Power source) and costs.

VII. Safety line and reel.

A. Road back to surface.

B. Desirable design characteristics of reel.

C. Reel size.

D. Proper line characteristics.

(1) Braided nylon

(2) #18, #4 - 160 lb. test.

(3) Undesirable lines.

E. Proper use of reel.

VII. Buoyancy compensator.

A. Why imperative.

B. Characteristics of a good B.C.

(1) Oral inflation vs. automatic inflation

(2) Pressure relief valve.

(3) Small neck volume.

VII. Protective clothing.

A. Dry suits (O'neal)

B. Wet suits.

(1) Thickness.

(2) Custom fitting.

(3) Farmer John.

IX. Slate.

A. Purposes for carrying.

(1) Recording.

(2) Communication.

(3) Desirable characteristics.

X. Depth guage(s)

A. Accurate decompression profile

(1) Deep accuracy.

(2) Shallow Accuracy.

B. Oil filled guages.

(1) Pros and cons.

C. Capillary depth guage.

XI. Watch.

A. Imperative characteristics.

B. Desirable characteristics.

(1) Self-winding.

(2) Locking bezel.

(3) Large face.

(4) Screw down crown.

XII. Submersible d/c tables.

A. Why imperative.

XII. Compass.

A. How and when used.

(1) mapping

(2) Off shoot lines.

XIV. Clothes-pins/outrigger clips.

A. Why used.

XV. CPG

A. Why imperative.

XVI. Mask and fins.

A. Desirable characteristics.

XVII. Logical thinking diver.

A. Best hardward will not replace.

B. Non-thinker.

C. 60 / 40 relationship.

ASSIGN STUDENT PAPERS

I. Body Positioning, swin techniques, buoyancy control.

A. Center of buoyancy.

(1) How to control

(2) Importance.

B. Center of gravity.

(1) How to control

(2) Imporatnce

C. Attitude (trim)

(1) Importance

(2) Buoyant states.

D. Swim techniques.

(1) Three part task to use.

a. Analysis of cave.

b. Selection of technique.

c. Successful employment.

(2) Explanation of commonly used techniques.

a. Why to pick individual techniques (8 reasons)

E. Practical experience.

F. Body positioning.

(1) Dependent factors.

(2) Explanation and diagrams of proper procedures.

I. Knots.

A. Knot tying practice (dry) Use of safety lines (lecture and land drill.

B. Reel use.

C. Compass use.

D. Basic line techniques.

E. Line techniques for spec ific situations.

(1) Current

(2) Silt

(3) Buddy Breathing

(4) Clay

(5) Breakdowns.

(6) Line movements

(7) Entanglements

(8) Fouling

II. Responsibilities of line installation.

A. Where should lines begin.

B. How accessible.

C. Routing and installation.

D. Special line techinques (line size).

III. Novice lines.

A. Pros and cons.

B. Line size.

IV. Lines in caves that traverse

A. How to run.

B. Where and how much gap.

V. Installation of exploratory lines.

VI. Dual lines.

VII. How to install off-shot lines.

VIII. Maintenance and repair of lines.

IX. Line awareness.

X. Line inspections.

XI. Swim attitudes.

PHILOSOPHY OF CAVE DIVING.

I. Good philosophy - broad w/many facets.

A. Physical mental relationships.

(1) 60/40

(2) Discussion of this relationship

II. Psychological adjustments.

A. Name and discuss individually each adjustment names - ask for more.

III. Assumption of responsibilities.

A. To ourself.

B. To our buddy

C. Diving population

D. Gneneral public.

E. Discuss each of these in detail.

IV. Self-Honesty.

A. Knowledge of our capabilities and limitations.

B. Not over-representing ourselves.

C. Establish a "personal" safe diving limit.

(1) Discuss what a "safe" personal limit involves.

V. Respect (common sense)

A. Live and let live.

B. Give and earn respect.

VI. Dive planning.

A. Plan should consider:

(1) Ability of least capable man considered.

(2) Max. depth.

(3) Penetration and air cut-off point.

(4) Dive master.

(5) Configuration and technique.

(6) Plans simple.

VII. Number of people per team.

A. Communications breakdown.

VIII. Maximums set - not goals.

IX. Functions of divemaster.

MEDICAL ASPECTS

I. Decompression illness.

A. Review of Gas exchange

B. Mechanical cause of bubble formation.

(1) tissue pressure

(2) Gas flow rates

C. Saturation of Tissues.

1. Tissue vs. blood (N_2 Saturation).

D. Factors relevant to bubble formation

1. Define biophysics role in bubble formation.

E. Size of bubbles

1. Critical size.

F. Where bubbles are found.

1. Symptoms depend on location.

2. Capillary lodging.

G. Decompression sickness in the CNS, brain, PNS.

1. Neurological damage - symptoms of each.

H. Joint involvment.

1. Most common.

2. Areas affected.

I. Chokes.

1. Symptoms.

2. Unusual fatigue.

J. Aseptic bone necrosis.

1. How detected.

2. Why caused.

K. Role of fat.

L. Contributing factors.

1. Dehydration.

2. Age

3. Restricted circulation.

(a) Explain "Reynolds cavitation effect."

4. Exercise at d/c stops.

5. High body fat.

M. Alcohol.

N. Diving with colds.

O. List of 7 preventative factors divers should do.

P. Explanation of "Haldane model".

1. Discuss each part

2. Supersaturation (1.58 to 1 ratio)

3. Ascent rate(s)

Q. Surface d/c stops

R. Automatic d/c meter.

1. Pros & cons.

S. Occurence of symptoms.

1. 10% in water, 50% in 1/2 hr., 85% in 3 hrs., 99% in 6 hrs.

T. Flying after diving.

U. Pharmaseutical treatment.

1. Heparine.

NITROGEN NARCOSIS.

1. Many caves 150' ≠

A. Avoid dives below 150' in caves.

B. Cannot ascend to reduce symptoms.

2. O_2 poisoning.

A. Review of causes and mechanisms

3. Causes, conditions and symptoms of pulmonary barotrauma.

A. Air embolism.

B. Mediastinal emphysema

C. Subcutaneous emphysema.

DIVE TABLES AND EMERGENCY PROCEDURES.

1. Review use of d/c tables.

2. Explanation of emergency procedures for ommited decompression.