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JANUS IV Phase II -1510 Feet

Sa Comex

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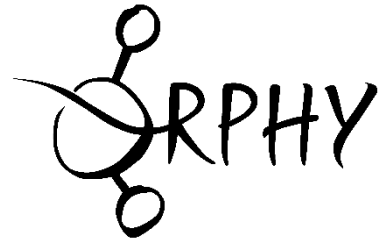
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COMEX (Compagnie Maritime d'Expertises), established in 1962, has positioned itself in the offshore activities sector, where it held a leading international position, becoming the world's foremost company in engineering, technology, and human or robotic underwater interventions. Comex designed a Hyperbaric Testing Center in 1969 and developed its own research programs on various breathing mixtures used in deep-sea diving (helium and later hydrogen). These research efforts led to spectacular advancements in this field, including several world records, both in real conditions and simulations. Comex still holds the world record at -701 meters, achieved in its chambers during Operation HYDRA 10.

The ORPHY laboratory focuses on major physiological functions, their regulation, interactions, and their contribution to the development and prevention of certain pathologies. The primary mechanisms studied involve metabolic aspects (oxygen transport and utilization, energetics, etc.) and electrophysiological aspects (contractility and excitability), mainly related to respiratory, vascular, and/or muscular functions. These mechanisms are studied under various physiological and physiopathological conditions, ranging from the cellular and subcellular levels to the entire organism. In Europe, the ORPHY laboratory is one of the leaders in hyperbaric physiology and diving research.

Being a major player in innovation and expertise in the field of pressure, COMEX maintains a scientific archive from its experimental diving campaigns. The value of this archive is both scientific and historical, as it documents a remarkable chapter in the history of marine exploration and contains results obtained during dives that are very unlikely to be replicated in the future.

comex

JANUS IV

BC

phase II

1510 FEET



C O M E X

" J A N U S I V "

REPORT OF PHASE II

June 30th, 1977

comex

C O N T E N T S

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I N T R O D U C T I O N

I N T R O D U C T I O N

On June 6th, 1975, aboard the dynamically positioned drilling vessel "HAVDRILL" off the Canadian coast of Labrador in waters of - 2°C., COMEX has performed a subsea operation with a team of divers at a depth of 326 metres / 1070 feet of sea water.

This intervention, undertaken for the petroleum industry, within the scope of their activities, confirmed that subsea work can be carried out by divers down to a depth of 326 metres / 1070 feet.

Now today, in 1977, COMEX is planning a real operational intervention at sea at a depth of 460 metres / 1510 feet.

This operation, named "JANUS IV", is a logical sequence to the research policy adopted by COMEX since 1965, and continuously backed by the French National Ocean Exploration Commission (C.N.E.X.O.).

The major milestones of this research were :

- September 1970 :

For the first time in the world, three divers worked on a subsea petroleum well-head and performed pipeline tie-in operations.

In this experiment, named "JANUS II", carried out at sea in 255 metres / 840 feet of water, 3 divers performed 4 hours of effective work per day for 8 days.

- November 1970 :

In the "PHYSALIE V" experiment conducted at the COMEX Hyperbaric Research Center, two divers reached and remained for 11 hours 20 minutes at a simulated depth equivalent to 520 metres / 1700 feet of sea water.

- February 1972 :

The "SAGITTAIRE II" experiment carried out in a hyperbaric chamber showed that two divers could remain for more than 100 hours at a depth of 500 metres / 1640 feet.

- May 1972 :

In the "PHYSALIE VI" experiment, also in a hyperbaric chamber, two divers reached the world record depth of 610 metres / 2001 feet for 1 hour and 20 minutes.

- May-June 1974 :

Two divers remained 50 hours in a chamber at 610 metres / 2001 feet.

- April 1975 :

Simulated wet dives in a hyperbaric chamber at 450 metres / 1500 feet.

The aim of this experiment which was named "JANUS III", being :

- . to check the physiological parameters already established during COMEX's world record 610 metres / 2001 feet dives in May 1972 and May 1974.
- . to check and perfect the individual diving equipment needed for such a deep dive at sea.

- 1976 / 1977 :

"JANUS IV"

The purpose of this real offshore experimental diving operation named "JANUS IV" was to confirm that :

- . Human intervention at 460 metres / 1510 feet of sea water is possible.
- . Work can be done at this depth which is already undertaken regularly in the 200 metres / 700 foot range and exceptionally in the 300 metres / 1000 foot range.

The dress rehearsal phase for operation "JANUS IV" was sponsored jointly by COMEX, CNEXO (Centre National pour l'Exploitation des Océans) and the FRENCH NACY (GISMER - D.R.M.E.) with COMEX acting as operator for the Group.

The entire operation was to consist of three phases, two preliminary preparatory phases, with the third and final phase being the real operation at sea in 460 metres / 1510 feet of water.

The first phase, whose aim was to detect any physiological inaptitude in a number of specific candidates, was successfully performed in October 1976.

The aim of the second phase was to rehearse the actual conditions which would be encountered at sea, as well as those related to living in a confined space at great depth, and to train the eight divers participating in the program.

Owing to the participation of the ELF-AQUITAINE Group, the dynamically positioned drilling vessel "PETREL" will be used for the third and final phase, real operation at sea.

I

E L E M E N T S E M P L O Y E D

F O R P H A S E I I

- A - H Y P E R B A R I C F A C I L I T I E S

E L E M E N T S E M P L O Y E D F O R P H A S E I I

- A - HYPERBARIC FACILITIES -

The COMEX Hyperbaric Experimental Center has at its disposition a modular saturation system named "EMS 600" (Ensemble modulaire de saturation).

The EMS 600 is a 2600 foot rated group of three spheres with full life support system. Closed circuit T.V. and video recording systems monitor all activities.

It is relayed with all measurement and monitoring equipment in the Hyperbaric Research Center. It also has its own hydraulic, electrical and gas controls.

This whole complex allows dives to be undertaken up to 800 metres / 2625 feet.

As concerns the JANUS IV project, its three identical spheres were used as follows :

- . one as living quarters for three divers (Living Accomodation N° 2)
- . one simulating the diving bell
- . one used as a pressurized pool in which the wet dives are made to simulate underwater working conditions.

In the Phase II of "JANUS IV", the COMEX Hyperbaric Experimental Center "EMS 600" complex was enlarged by coupling two additional chambers to it, a 2000 mm diameter and a 2300 mm diameter, which afforded greater flexibility.

(See pp. 3 - 5)

- The 2300 chamber served as living quarters for five divers
(Living Accomodation n° 1)

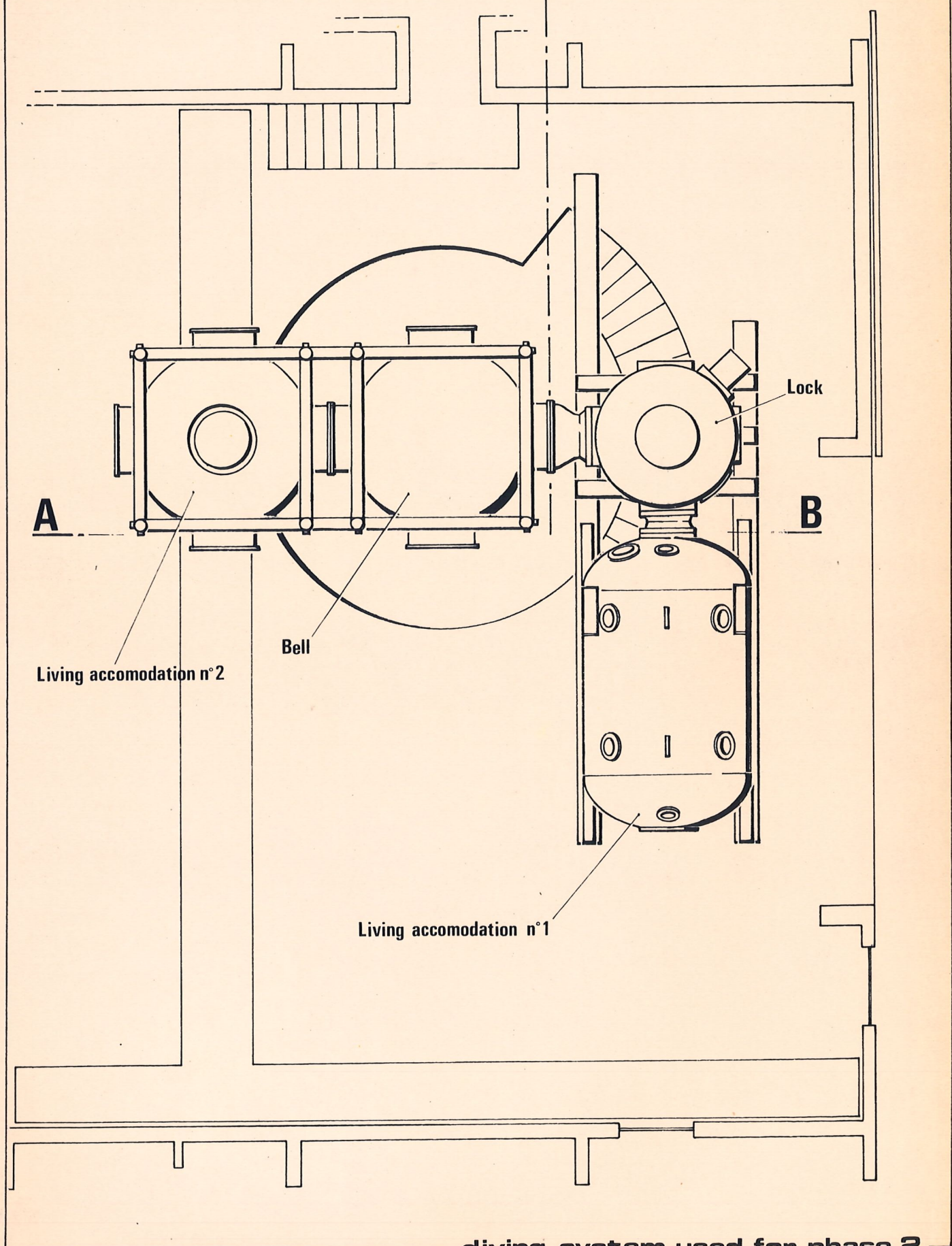
- The 2000 chamber was used as a lock.

THE "EMS 600" HYPERBARIC SYSTEM AND
THE TWO SUPPLEMENTARY CHAMBERS.

PLAN VIEW.

EMS 600 Hyperbaric System

Supplementary System



A

Lock

B

Living accommodation n°2

Bell

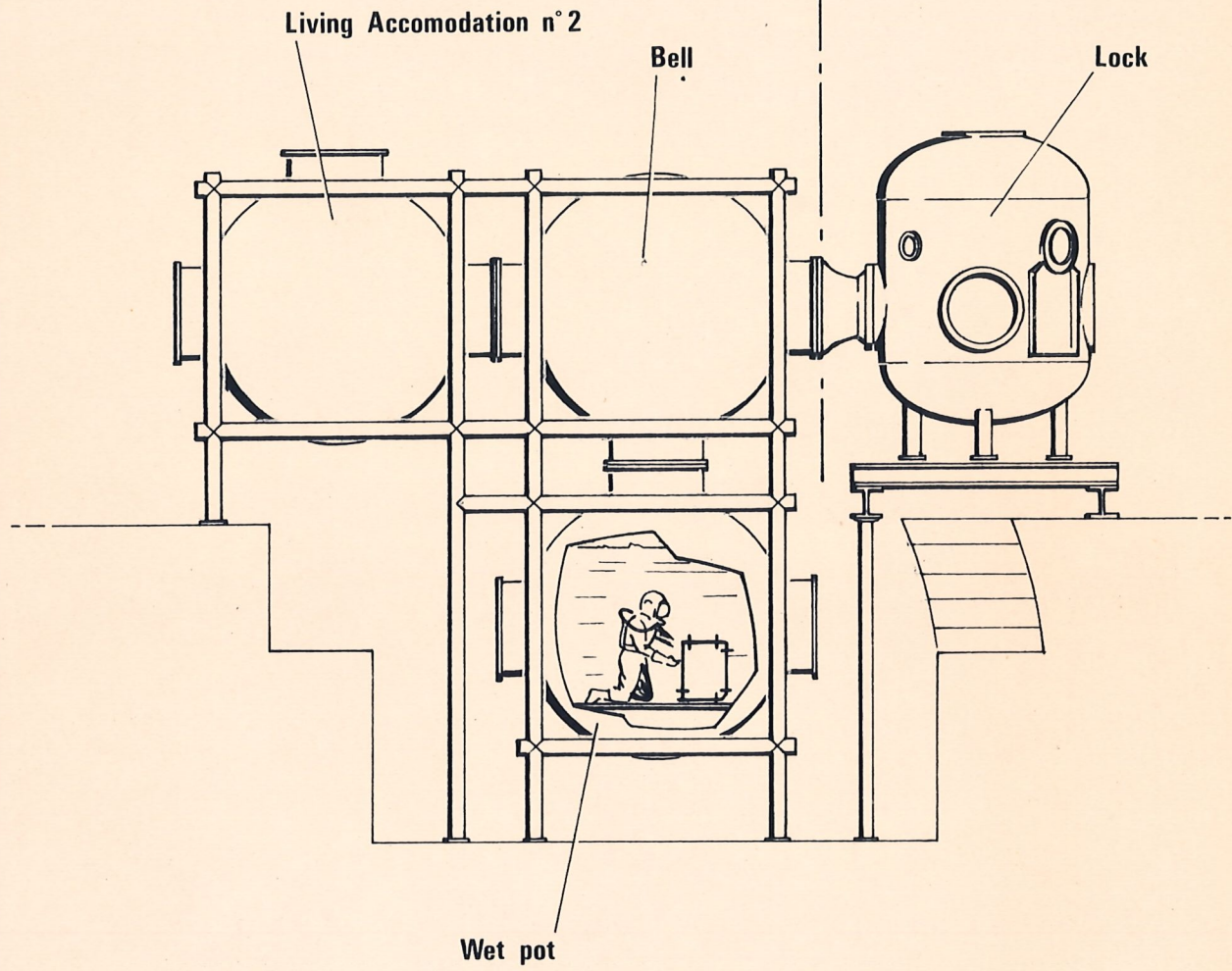
Living accommodation n°1

diving system used for phase 2

CROSS-SECTIONAL. View A-B

EMS 600 Hyperbaric System

Supplementary System



diving system used for phase 2

- B - P E R S O N N E L

- B - PERSONNEL -

Eight volunteer divers were preselected during phase I, "Personnel Selection".

Qualification was determined on the basis of a series of tests comparing diver performance in respect to :

- . sensitivity to compression
- . sensitivity to high pressure
- . alertness
- . dexterity
- . physiological tests
- . biological tests
- . self-analysis

These eight divers performed six days of training dives during phase II consisting of :

- . four dives at 430 metres /1410 feet
- . two dives at 445 metres /1460 feet
- . six dives at 460 metres /1510 feet
- . one dive at 480 metres /1575 feet

for a total of 25 hours and 41 minutes in-water time.

A Table of the personnel selected is to be found on the next page.

D I V E R S S E L E C T E D

NAME	AGE	PROVENANCE	DATE OF ENTRY	BOUNCE DIVING EXPERIENCE	SATURATION DIVING EXPERIENCE	MAXIMUM DEPTH REACHED TO DATE
JEANTOT Philippe	24 years	COMEX	25/ 06/ 1975	X	X	210 metres
LENTINI Vito	24 years	COMEX	01/ 04/ 1974	X	X	180 metres
MAC KENNA John	38 years	COMEX	11/ 01/ 1975	X	///////	180 metres
RAUDE Patrick	26 years	COMEX	07/ 03/ 1974	X	X	326 metres
SCHNEIDER Louis	25 years	COMEX	02/ 09/ 1974	X	X	210 metres
SEVELLEC Emile	35 years	FRENCH NAVY	1963	X	X	180 metres
VERPEAUX Jacques	26 years	COMEX	23/ 06/ 1975	X	X	180 metres
VIAL Gérard	31 years	FRENCH NAVY	1966	X	X	260 metres

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- C - W O R K T A S K

- C - WORK TASK -

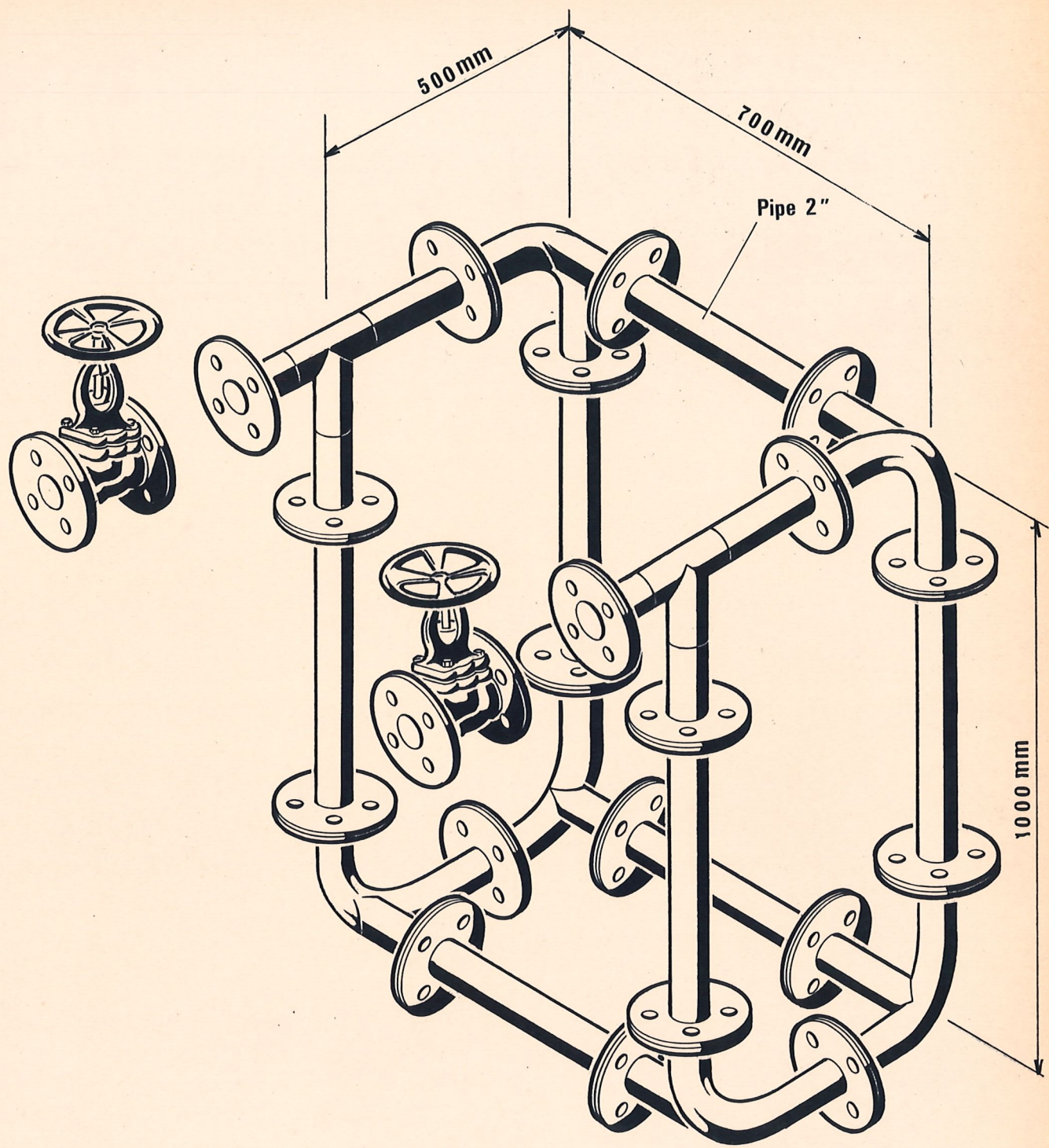
The work task provided was the assembly of flanged parts of 2" piping constituting a puzzle (see pp. 9-10)

Having the divers work on the pipe-puzzle assembly permitted a comparison of each diver's performance regarding :

- . dexterity skills,
- . concentration and reflex capacities necessary to install each part in the correct place,
- . physical strength needed to tighten and seal the flanges before pressurizing the pipe-puzzle assembly when testing for leaks.

The assembly of the pipe-puzzle had first been undertaken in a swimming pool by each diver in the team and the time needed for assembly had been clocked.

Time measurements were again made at the working depth to provide a comparison of the divers' performance at depth.



A View Of The 20 Flanged Pipe Parts Which Constitue The Puzzle Assembly For Phase II

a view of the 20 flanged pipe parts

THE DIVER STARTING ASSEMBLY OF ONE OF THE FACES OF THE CUBIC PUZZLE

THE PUZZLE ONCE ASSEMBLED, THE DIVER TIGHTENS UP
THE FLANGES BEFORE THE PRESSURE TEST

I I

GENERAL PROGRAM

- A - SCHEDULE

CELESTON

PHASE I I JANUS I V T I M E T A B L E

Nov 22/12 1976

	WEDNESDAY 1/12	THURSDAY 2/12	FRIDAY 3/12	SATURDAY 4/12	SUNDAY 5/12	MONDAY 6/12
TEAM A	START OF CONFINEMENT PERIOD	CONFINEMENT	START OF COMPRESSION	ARRIVAL AT LIVING DEPTH 400 m. / 1310 ft.		INDIVIDUAL EQUIPMENT 430 m. / 1410 ft.
TEAM B		START OF CONFINEMENT PERIOD	CONFINEMENT		START OF COMPRESSION	ARRIVAL AT LIVING DEPTH 400 m. / 1310 ft.

	TUESDAY 7/12	WEDNESDAY 8/12	THURSDAY 9/12	FRIDAY 10/12	SATURDAY 11/12	SUNDAY 12/12
TEAM A	DIVE 1 at 430 m. / 1410 ft.	DIVE 3 at 430 m. / 1410 ft.	DIVE 5 at 445 m. / 1410 ft.	DIVE 7 at 460 m. / 1510 ft.	DIVE 9 at 460 m. / 1510 ft.	DIVE 11 at 460 m. / 1510 ft. and DIVE 11 BIS at 480 m. / 1575 ft.
TEAM B	DIVE 2 at 430 m. / 1410 ft.	DIVE 4 at 430 m. / 1410 ft.	DIVE 6 at 445 m. / 1410 ft.	DIVE 8 at 460 m. / 1510 ft.	DIVE 10 at 460 m. / 1510 ft.	DIVE 12 at 460 m. / 1510 ft.

JEANTOT Philippe
 RAUDE Patrick
 SCHNEIDER Louis
 VERPEAUX Jacques

TEAM A

TEAM B

LENTINI Vito
 Mac KENNA John
 SEVELLEC Emile
 VIAL Gérard

1. Timetable

PHASE I I J A N U S I V T I M E T A B L E (D E C O M P R E S S I O N)

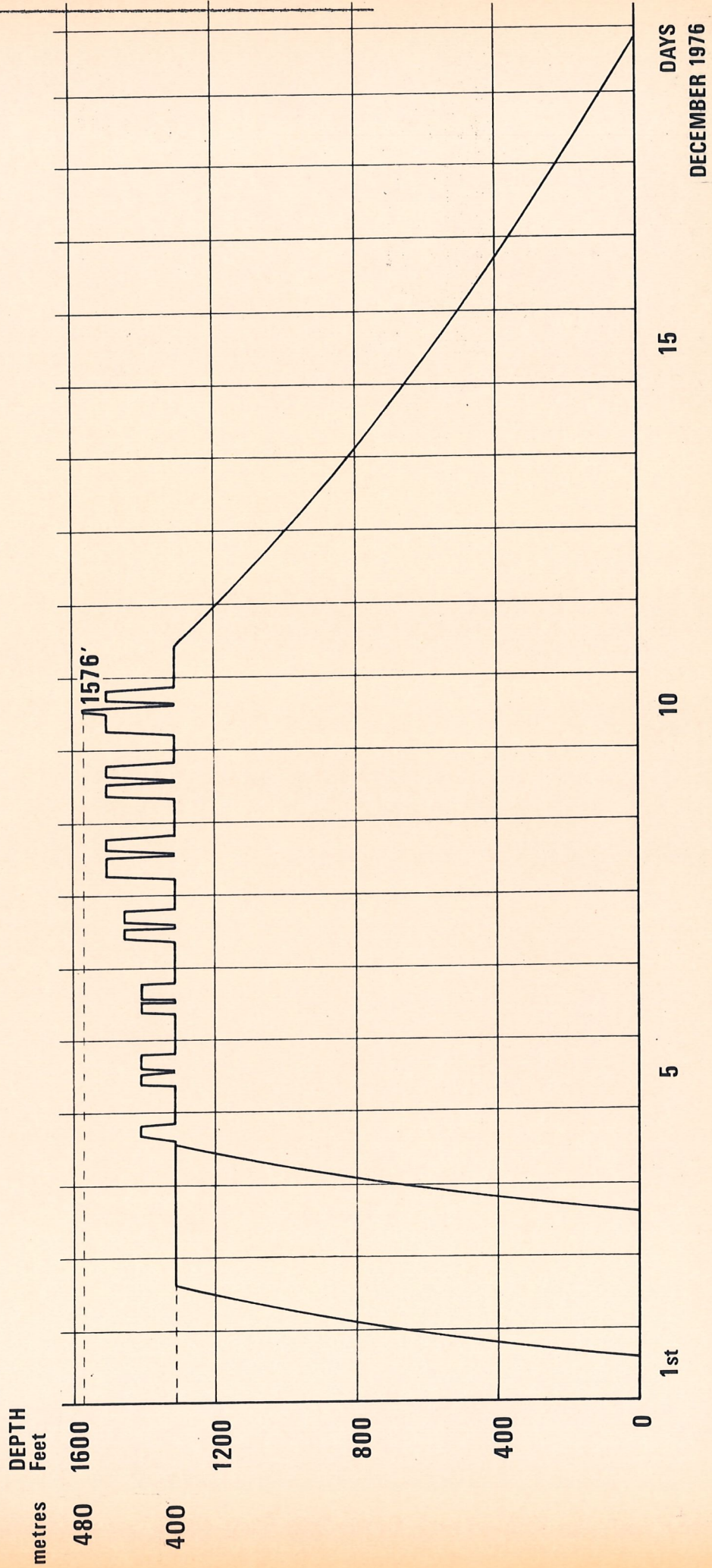
	MONDAY 13/12	TUESDAY 14/12	WEDNESDAY 15/12	THURSDAY 16/12	FRIDAY 17/12
TEAM A and	START OF DECOMPRESSION	DECOMPRESSION 20 H 00 330 m. / 1090 ft.	DECOMPRESSION 18 H 00 260 m. / 860 ft.	DECOMPRESSION 19 H 00 230 m. / 760 ft.	DECOMPRESSION 20 H 00 170 m. / 560 ft.

	SATURDAY 18/12	SUNDAY 19/12	MONDAY 20/12	TUESDAY 21/12	WEDNESDAY 22/12
TEAM A and TEAM B	DECOMPRESSION 19 H 00 125 m. / 410 ft.	DECOMPRESSION 20 H 00 75 m. / 250 ft.	DECOMPRESSION 18 H 00 40 m. / 132 ft.	DECOMPRESSION 12 H 00 15 m. / 50 ft.	DIVERS OUT at 8 H 15

TEAM A {
JEANTOT Philippe
RAUDE Patrick
SCHNEIDER Louis
VERPEAUX Jacques

TEAM B {
LENTINI Vito
Mac KENNA John
SEVELLEC Emile
VIAL Gérard

PHASE II PRESSURE PROFILE



- B - C O M P R E S S I O N P H A S E