

BUOYANCY PACKAGE FOR SELF-CONTAINED ACOUSTIC DOPPLER CURRENT PROFILER MOORING

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ABSTRACT

A buoyancy package for self-contained Acoustic Doppler Current Profiler (SC-ADCP 1200 RD Instruments USA) was designed and fabricated indigenously, for subsurface mooring in coastal waters. The system design is discussed. This design to keep SC-ADCP in upright position and easy to handle and is suitable for deploying from a small boat. The mooring system has been successfully test deployed.

1. INTRODUCTION

Acoustic Doppler Current Profilers (ADCP) are now widely in use for accurate current measurements with high vertical coverage and resolution which are not practically attainable with current meters. Different types of moorings are designed for ADCPs depending upon its range and configuration.

An ADCP with a range of maximum 30m (RD-SC 1200) is very useful in studying currents in relation to the estuarine and coastal dynamics. Usually an ADCP is mounted (facing upwards) on frames which can sit at the sea bottom. Alternatively ADCP is attached to a subsurface mooring where it is free to change its orientation. Different users, for example, University of New Hampshire, Benihos Inc., have designed different types of frames and moorings and flotation packages (Fig.1) for ADCPs (Anonymous, 1987). ADCP (RD- SC 1200) mounted horizontally on a bottom platform with transducers facing up (elbow fitting) was moored at 12m depth in the port of Miami for 5 days (Gerald et al 1985).

Specially made synthetic foams are also available for ADCP. ADCPs mounted on sea bottom frames are not preferred due to the limitations in handling large structures through small boats in estuaries or coastal waters where large ships cannot venture.

The paper describes the design of a new buoyancy package for ADCP (RD-SC 1200) which could be easily handled from a small boat, keeping the operational conditions in view and the size constraints of the existing buoyancy packages.

2. DESCRIPTION OF THE SYSTEM AND BUOYANCY PACKAGE

ADCP measures the range segmented velocity profiles of watermass velocity, echo spectral width and echo amplitude. It measures the watermass velocity by measuring the Doppler frequency shift of the back scattered watermass echo by using its four transducers. These are oriented at 90° intervals of azimuth and at 20° to the vertical instrument axis. It has a frequency of 1228.8 KHz with configuration facing up. It has a barrel diameter of 550 mm and a height of 1450 mm. This

system incorporates a fluxgate compass to measure the heading and a tilt sensor which can correct the tilt upto 20° (Anon., 1990).

To keep the ADCP in the near vertical position a buoyancy package was necessary. It consisted mainly of two vinyl floats and an aluminium alloy frame in two halves (Fig.2). Aluminium alloy was preferred due to its light weight, better corrosion resistance and its non-interference properties in relation to the functioning of fluxgate compass. Metal inert gas welding (MIG), using parent metal as filler material, was employed to fabricate the frame so as to minimize corrosion of the welded portions. Care was taken to remove weld-burrs and sharp corners. Stainless steel fasteners were used to assemble the frame, floats and ADCP. Intermetallic corrosion was avoided by electrically insulating the stainless steel parts and aluminium parts. An aluminium pipe of 75 mm diameter and 100 mm length was fitted at the bottom of the frame to protect the electric connector of the ADCP. The frame was coated with zinc chromate marine paint for corrosion protection.

The technical details are given below:

	In air Kg	In water Kg
Weight of ADCP	48	9
Weight of buoyancy package	15	10
Weight of ADCP and buoyancy package	63	-
Total buoyancy of 2 vinyl floats	-	80
Net buoyancy of system	-	61

3. MOORING CONFIGURATION AND SEA TRIALS

The ADCP fitted to the buoyancy package (Fig.3) was attached to an anchor weight of about 150 Kg using four stainless steel chains of one metre length. U-type mooring was preferred so that beam of ADCP transducers are not obstructed by floats. For site-specific operational reasons we did not use acoustic releases. The trial mooring was first deployed at 12m water depth for four hours in the sea. Later,

as the test was found successful and the operation convenient, the system was moored at 19m water depth (Figs.4 & 5) for a longer period of time (5 days).

4. RESULTS AND DISCUSSION

1. The data collected from the sea trials shows that the maximum tilt recorded by the tilt sensor was less than 3° for an average current speed of 50 cm/sec.
2. Even after five days of mooring the system, the frame remained intact, and required very little maintenance for subsequent deployment.
3. The design of this buoyancy package is versatile such that any type of float with the required buoyancy can be attached to it.
4. This buoyancy package is very light in weight and occupies less space. It can be easily transported, assembled and dismantled on the boat.
5. It can be attached to an acoustic release, if needed. It can also be attached to long mooring lines for higher depths.

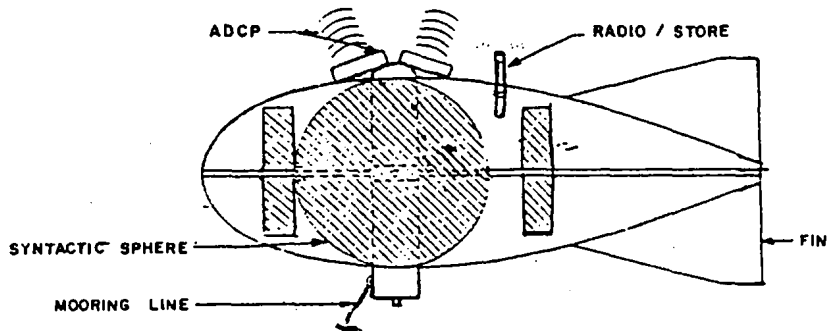
6. The design being an import substitute, is cost effective considering the foreign exchange involved in importing the existing systems from abroad.

ACKNOWLEDGEMENTS

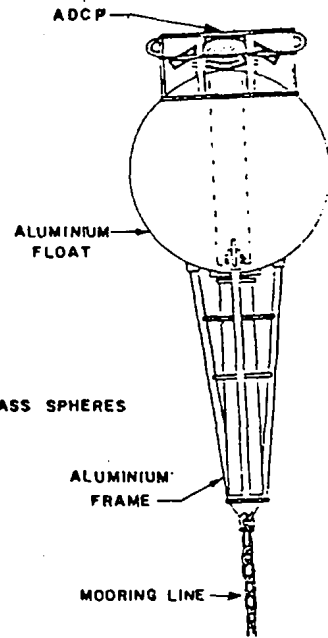
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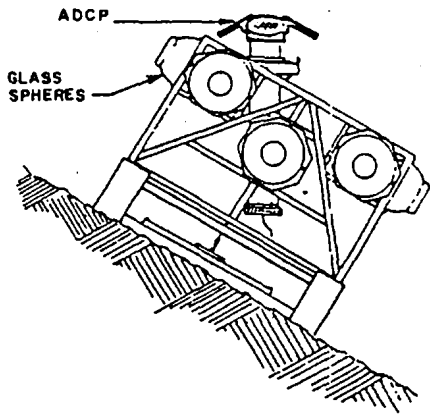
1. Anonymous, 1987, *RD Instruments Application*, Note 7.
2. Anonymous, 1990, *Acoustic Doppler Current Profiler*, RD Instruments System Operators Manual.
3. Gerald F. Appel., Thomas N. Mero., James J. Sprenke and Donald R. Schmidt, 1985, *An Interpretation of Two Acoustic Doppler Current Profilers*, Proc. Oceans '85, Ocean Engineering and the Environment. (Conference Record) Vol. of 2, pp.723-730.



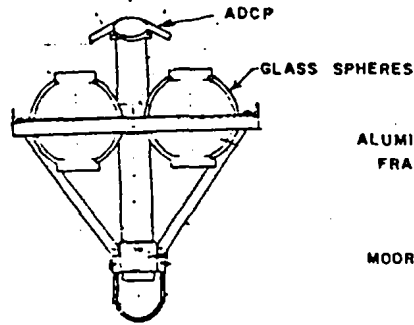
a. TORPEDO SHAPED FLOAT (JAO-TECH)



d. FLOATATION PACKAGE USED BY UNIVERSITY OF NEW HAMPSHIRE



b. BOTTOM MOUNTED FRAME (UNIVERSITY OF NEW HAMPSHIRE)



c. BENTHOS FLOATATION PACKAGE

Fig. 1. VARIOUS TYPES OF FLOATATION PACKAGES (ANONYMOUS 1987).

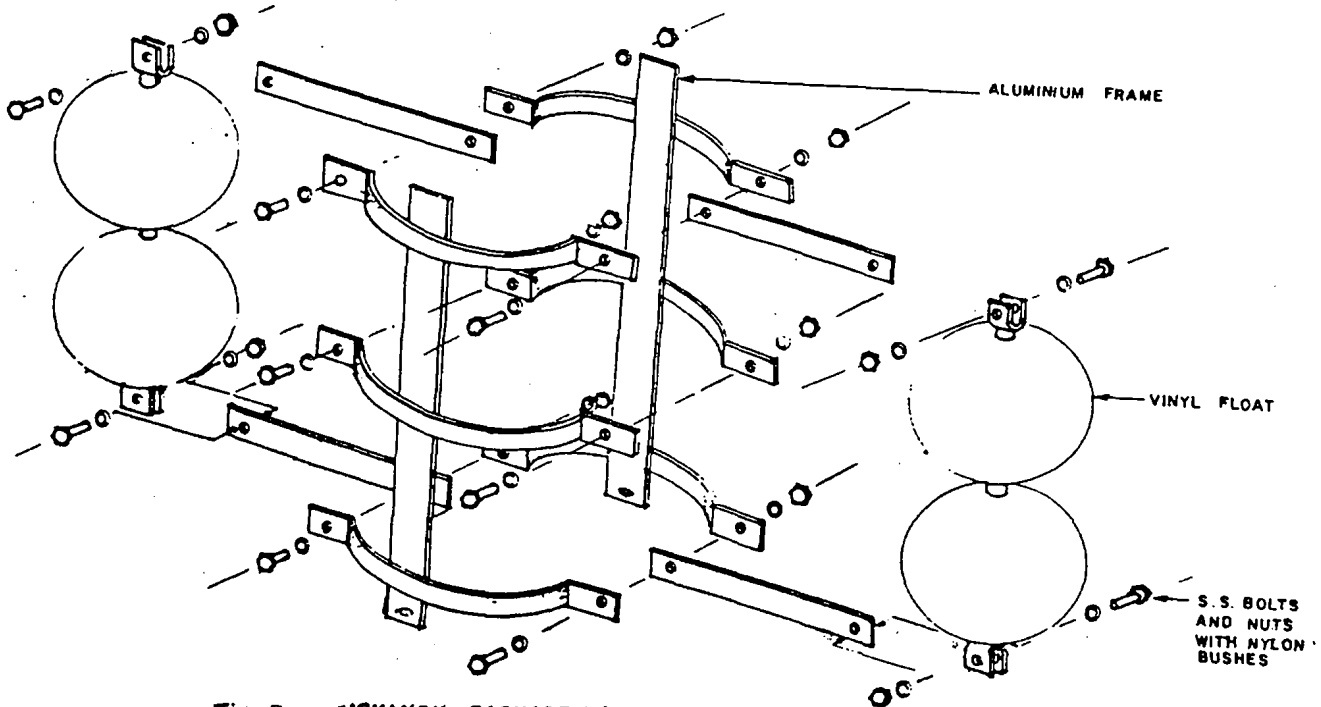
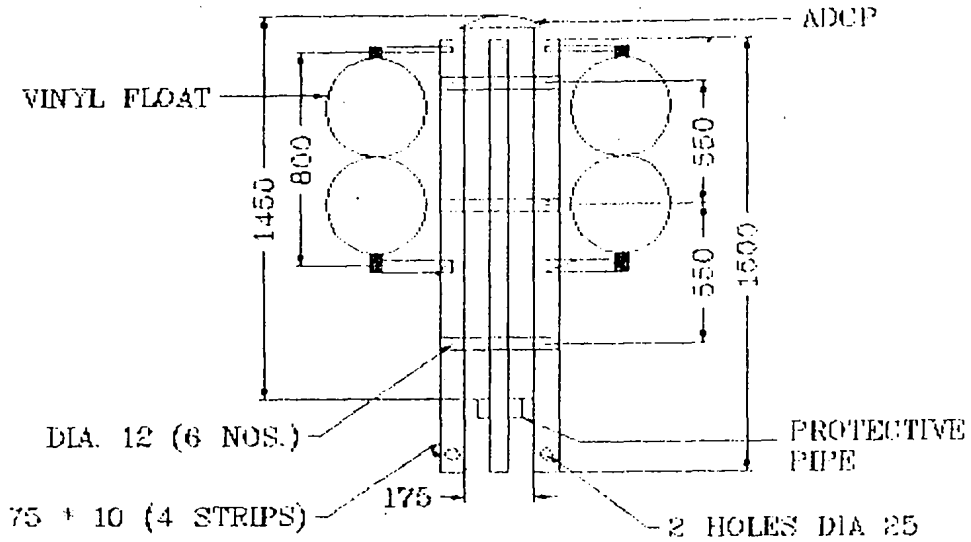


Fig. 2. BUOYANCY PACKAGE (EXPLODED VIEW)

figure not to scale.



MATERIAL: ALUMINIUM ALLOY

Fig. 3 - Buoyancy package with ADCP Assembly

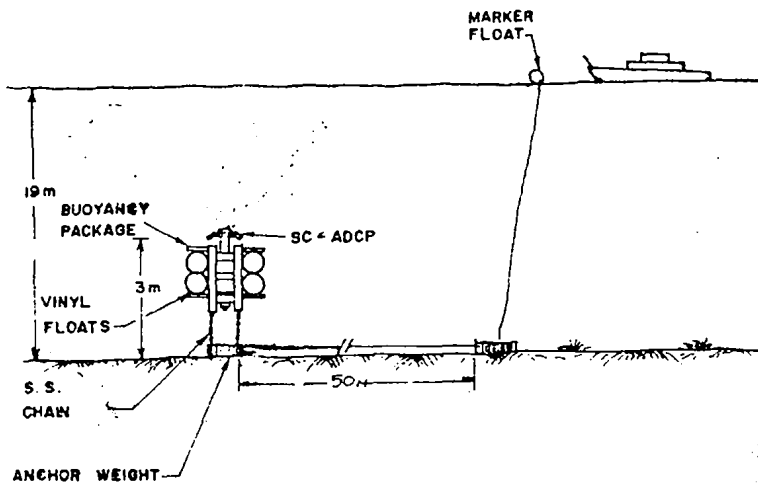


FIG.4 SCHEMATIC DIAGRAM OF ADCP MOORING



Fig. 5 - Assembly and Deployment of Buoyancy Package with ADCP