An analog/digital cable design for rapid land 3-C acquisition

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ABSTRACT

One of the biggest challenges to acquiring land 3-C seismic surveys using analog cables is the connection of the geophones to the recording system. Without custom-built 3-C cables, there is a high likelihood of tangling during cable deployment and pick-up. In addition, the multitude of connectors at each geophone station provides ample opportunity for cross-wiring geophone components. A 3-C geophone cable is designed that addresses these issues. The cable is designed for 8-channel field digitization units. It combines all the conductors of three single-component cables into a single molded cable. A single 6-conductor connector is applied to each take-out, greatly simplifying the connection of geophones. A prototype of the cable is currently being constructed by ARAM Systems Ltd., and field tests are planned for early 2007.

INTRODUCTION

One of the greatest impediments to the adoption of multicomponent surveying is the complexity of connecting 3-C geophones to the recording system. The use of cables designed for single-component geophones with three-component geophones results in complex wiring arrangements. Most of these layouts are performed using a collapsed 3-D approach (Figure 1) or a serpentine approach (Figure 2). The likelihood of wiring errors is high because there are three possible connections at each geophone station, and three possible connections at each cable interface.

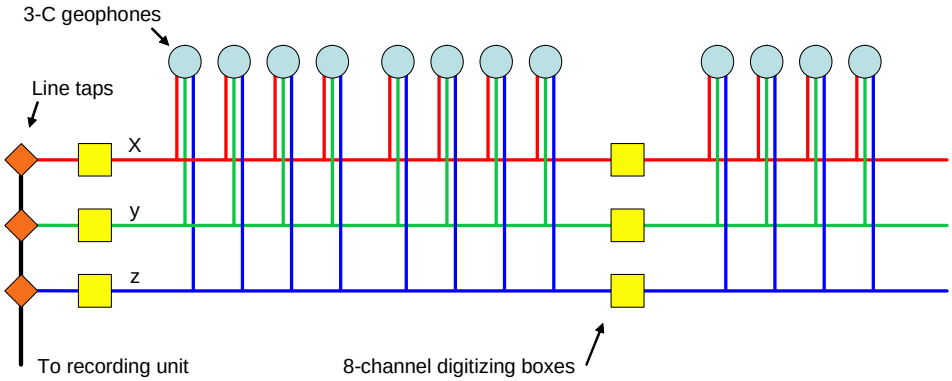

Figure 1. Collapsed-3D layout for recording 3-C geophones using 1-C cable. The survey is configured like a patch of three receiver lines in a 3-D survey.

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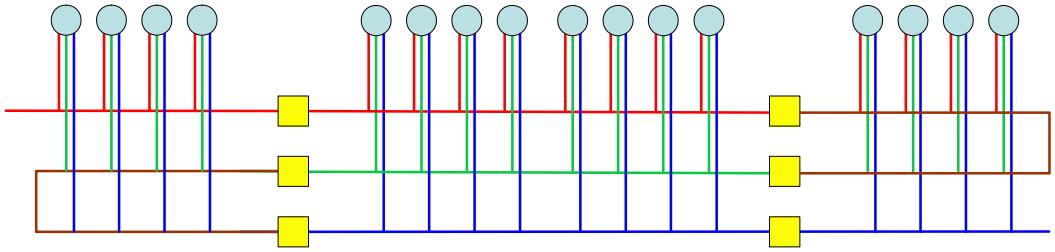

Figure 2. Serpentine geophone wiring pattern. In the serpentine wiring pattern the cable is folded back at the beginning-of-line and end-of-line to form a continuous recording pattern.

An additional concern with using single-component cable is the likelihood of tangling cable. With so many cables situated close to each other, there is a real likelihood of tangling cables and delaying the recording program.

The new 3-C cable designed presented here, is designed specifically for the Aries recording system manufactured by ARAM Systems Ltd. The general concept could be applied to any recording system that uses a multiplicity of field digitization units interconnected by geophone cable. The concept is very simple: bundle groups of three single component cables into a single molded unit. An additional and significant simplification of the wiring is that 3-C geophones are connected to the cable by a six-conductor geophone plug. Reducing the number of field connections drastically improves layout time. With a single six-conductor plug, there is no chance of plugging the wrong geophone component into the wrong receiver line. We have had good success in using the OYO Geospace KCX-6 connector for connecting 3-C geophones (Figure 5).

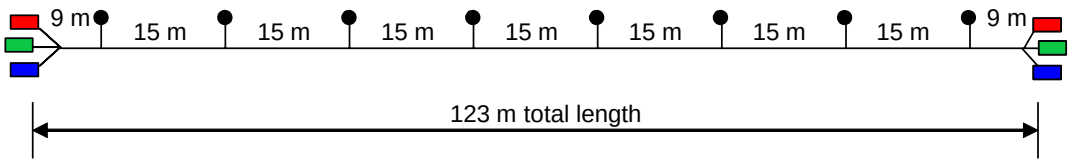

Figure 3. Top level design for the new 3-C geophone cable. Geophones are connected to the take-outs (indicated by black dots) located at 15 m intervals along the cable.

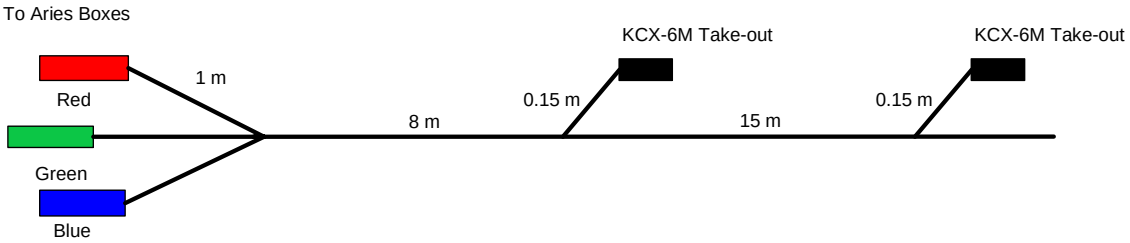

Figure 4. Detail showing and end of the 3-C cable and some of the detailed dimensions.

Figure 5. Oyo Geospace KCX-6F connector.

Figure 6. OYO Geospace KCX-6F connector and plug. The female connector (shown above) is connected to the geophone. The male connectors (KCX-6M) are located on the cable take-outs. Since both connectors have pins and sockets, the gender is determined by the rubber housing.

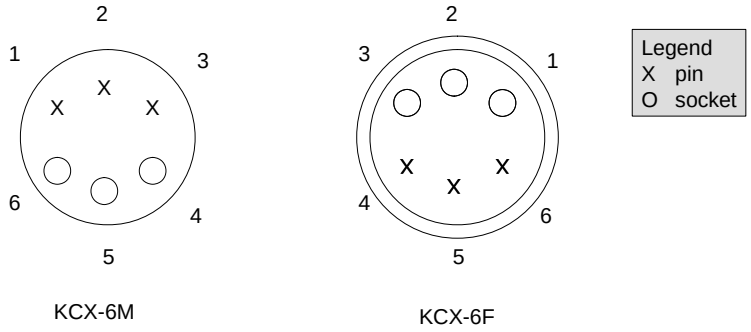

Figure 7. Pin-out of the KCX-6 connector as viewed from the connector end.

Electrical wiring

Our overall strategy is to keep the order of pins, components and colors as regular as possible. The color order of Red, Green, Blue is common in multicomponent seismology. We map these colors to the X, Y, and Z geophone components (also known as H1, H2, and Vertical). The take-outs have six pins. We pair these pins based on the geometry of their layout. If we look at the KCX-6M connector in Figure 7 we see that opposite pin 1 is socket 6. We pair pin 2 with socket 5, and pin 3 with socket 6. We assign the positive conductor of the geophone element to pins 1, 2 and 3, and the negative to sockets 4, 5 and 6. Geophone cable is wired so that the Red geophone plug connects to pins 1(+) and socket 6(-) of the KCX-6M connector. The Green geophone plug connects to pin 2(+) and socket 5(-), and the Blue plug connects to pin 3(+) and socket 4(-). The intended mapping to 3-C geophones is X-component, Y-component and Z-component respectively. Though not necessarily a wiring issue, it should be stated that our polarity convention places Z down, X along the receiver line (pointing in the increasing station-number direction and Y perpendicular to the receiver line direction at the 3 o'clock position (with X at 12 o'clock).

DISCUSSION

The geophone cable described in this short note is being designed and tested by ARAM Systems Ltd. We hope to test a prototype of the cable in the next few months, and look forward to general availability of this cable to ease the task of shooting land 3-C surveys.