



DNE's AN/FCC-100 Multiplexer: A Work In Progress



AN/FCC-100 History

Overview

In this day and age of networks, intranets, and the Internet, who would possibly be using point-to-point time-division multiplexing? To find the answer, just ask a communications officer in any deployed division of the US military services. The answer would be nearly unanimous: They all are. Since its inception in 1980, the AN/FCC-100 Time-Division Multiplexer has nearly 15,000 units deployed to various service branches, joint forces, and NATO troops - and demand for this time-tested multiplexer shows no signs of slowing. The multiplexer's manufacturer, DNE Technologies, Inc., has announced that it recently redesigned most of the AN/FCC-100's individual cards so it will be able to continue to support the military's heavy reliance on this essential tactical communications unit for many years to come..

"Our customers love the AN/FCC-100, and rely on it in some critical situations," stated DNE Technologies President and CEO William Gill. "Its life has extended well beyond what we envisioned in 1980 and demand for it remains high. We needed to redesign most of it to continue to support demand, as well as deployed units." He added that recent world events, such as Operation Desert Storm, peacekeeping missions in Bosnia, and Operation Enduring Freedom have contributed to the steady demand for the battle-tested communications product.

Let's face it. There's not much left from the early 1980's that isn't considered a classic, an oldie, or an antique. In fact, today's computer technology necessitates tossing away your old computer and buying a new one approximately every two and a half years. So how can a 23-year old communications unit still be in such heavy demand?

To DNE Technologies, the answer is simple - despite it's age, the AN/FCC-100 is still a work in progress. Advancements in processor speeds, chip technologies, compression algorithms, and network management are all continually incorporated into the AN/FCC-100 to ensure tactical communications continue uninterrupted. Only the chassis remains the same.

A multiplexer is a unit that can combine many different data and voice channels - in the case of the AN/FCC-100, up to 16 - compress them, and send them out over one circuit. Another AN/FCC-100 on the remote end takes this aggregate stream and re-divides it into the individual original circuits. This allows many types and speeds of data and voice to travel economically over a single communications link, such as a satellite or microwave radio signal. This type of communication is critical in areas where normal telephone lines are unavailable, either due to the remoteness of the location or as a result of battle damage.

The AN/FCC-100 was created in 1980 in response to a Tri-services bid for such a product. At the time, DNE Technologies (then known as Dataproducts New England) was already manufacturing and deploying a time-division multiplexer known as the MC3, or the Multi-Channel Crypto Controller. The MC3 was one of the first multiplexers to control

16 encrypted or non-encrypted channels with a microprocessor. Dataproducts New England merely needed to add some features specified by the DoD to win the bid handily, and the AN/FCC-100 was born.

The original AN/FCC-100 was a Low Speed Time Division Multiplexer (LSTDM) with an aggregate range of 1200 baud to 256kbps. It was offered either in (V)1 DC power or (V)1X AC power. Although its ports only handled up to 64kbps of data traffic, Dataproducts sold thousands of them soon after it was mass-produced beginning in early 1982.

Despite its almost immediate adoption by the DoD, the multiplexer was still coming of age, growing into a more useful unit. In 1983, the (V)2/2X versions were introduced, adding embedded tests and some voice capabilities, using Pulse Code Modulation (PCM) at 64kbps and Continuously Variable Slope Delta (CVSD) at 16, 32, and 64 kbps. Now, the AN/FCC-100 could pass phone traffic in addition to data.

While the military was busy buying these units, many government contractors were busy buying a commercial version of this unit, called the DPMUX-256. In 1984, the unit was renamed the DPMUX-2048, and nomenclatured as the (V)3X. This new unit was a radical change from the previous versions, with the maximum aggregate rate increased to 2048kbps and the individual port rates increased to 512kbps. V4/4X added ADPCM compression, as well as a Telemetry sub-multiplexer, and a Network Control Facility that examined local and remote configurations as well as allowing up to 99 AN/FCC-100s to be daisy-chained.

The advent of Desert Storm in 1991 prompted another upgrade to the AN/FCC-100, this time adding Tactical Conditioned Di-Phase (T-CDI). Version 5 had a simple 40-60 Hz AC power supply, while Version 6 offered more robust 50-400 Hz power.

Quick Fact: There are 1.49×10^{33} possible combinations of AN/FCC-100 processors, option cards, revisions, rates, and options. To configure all of them just once would take 520,000,000,000,000,000,000,000,000 years.

1996 saw yet another major upgrade to the AN/FCC-100, this time adding several new modules, including FXS, FXO, and 4-wire E&M without the need for piggybacked CELP (Codebook Excited Linear Predictive) algorithm cards. In Versions 7 (AC) and 8 (DC), CELP was offered as a separate voice compression module. Additional rates, compression algorithms, and interfaces were also made available in these new versions. During the production of these versions of AN/FCC-100s, the front panel display changed from a red LED module to a backlit LCD module.

In 1999, network management was widely implemented throughout many DoD computer networks, and DNE responded by adding the capability of Simple Network Management Protocol (SNMP) to the AN/FCC-100. This allowed SNMP management software to communicate to and configure remotely the AN/FCC-100 as well as identify and correct alarms from a single network site.

While the development of the AN/FCC-100 multiplexer progressed over the years, it is more remarkable that DNE made the effort to ensure that each version was backwardly compatible, and simple to upgrade. With each new release, field upgrade kits were also made available, while at the same time assuring that these new multiplexers remained backwardly compatible to non-upgraded units. In fact, today's AN/FCC-100(V)9 can communicate to an AN/FCC-100(V)1, albeit at a port rate of 64kbps and an aggregate rate of 256kbps - maximum for the (V)1. (A full listing of upgrades and compatibilities can be found at: <http://www.dnetech.com/techsupport/FAQS/anfcc-100info.pdf>.)

The creation of a unit based on a 1980 microprocessor brings up the issue of obsolescence. Redesigning around obsolete parts is a continuing challenge to any manufacturer. Most look for a simple replacement of a capacitor, a processing chip, or a resistor, and DNE is no exception. DNE Technologies has a team whose task it is to identify parts that may become obsolete and then recommend, test, and implement replacements before this issue affects the customer.

Over time, DNE has substituted, redesigned, and replaced obsolete parts, processors and chips in what has largely been a seamless transition in the eyes of the customer. Nearly every card DNE offers as an option to the AN/FCC-100 has undergone some redesign. In most cases, the customer wouldn't notice a different brand of chip, although the speeds, size, or connections may have changed.

But there occasionally comes a time where technology advancements dictate an entire redesign. DNE's most recent redesign in 2002 truly highlights the distance technology has come since the AN/FCC-100 was first introduced. Cards that were designed in years past can now perform the same function with just a few chips, reducing both the complexity and the weight of each card. Using surface-mount technology rather than the older through-hole technique, each card is now easier to manufacture, test, and troubleshoot than in years past. This results in a higher quality product, which is more robust and more reliable than ever before.

Figure 1 (right) shows several versions of the Mux/Demux card offered over time by DNE. Clearly, the latest board is a radical departure from the original (top) one, but DNE stresses that each card is designed to be backward compatible so that new cards can talk to old cards, without exception. Each card is tested back-to-back with older revisions of cards, then tested in older chassis with older processors, as well as in brand-new units. The goal is to be a "form, fit, and function" one-for-one replacement.

Almost all the internal AN/FCC-100 cards will be redesigned and reintroduced in 2003. In addition to the Mux/Demux card above, DNE is finishing up the FXS card redesign for release in the spring. This will be followed by the FXO and the E&M cards, also planned for a spring release. The processor and the port carrier will be overhauled by the end of 2003. DNE emphasizes that some additional cards - most notably daughter cards - are already redesigned to immediately step in when a part on an old card renders it obsolete.

But redesign of the AN/FCC-100 goes far beyond the option cards. Power supplies, fan assemblies, processors, and even the front display panel have all been changed during the lifetime of the AN/FCC-100, some more than once.

The amount of memory and the power of updated processors on these newly redesigned cards leaves the possibility of another future variation wide open. All DNE will say is that they are "closely examining the possibilities and the demand" for future enhancements.

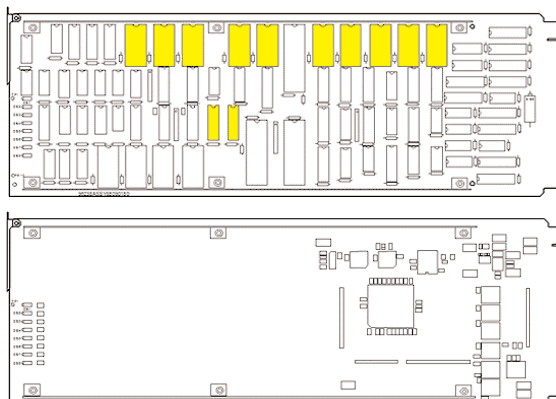
When asked about the AN/FCC-100, DNE Director of Engineering, Wayne Addy, declared, "There is nothing on the horizon that I can see right now that would prevent me from supporting this product, given the extensive redesign we've undertaken." He added that any future features and enhancements will be designed to preserve the backward compatibility, and that the cost of any potential new upgrade must be affordable to the users. "The feature must justify the cost - We can't add one rate and charge \$5,000 for it, but if we doubled the aggregate rate, that benefit might justify a costly upgrade." He stressed that while they are "looking at everything with an eye to improvement," nothing will be decided until the testing on all the card redesigns are complete.

"DNE has a solid history of providing support to our customers - it's one of the things we hear most often from them is how great our support is," said Charles Reese, Vice President of Sales and Marketing for DNE Technologies. "The other thing we hear is how they love the AN/FCC-100 because it's so rugged, reliable and easy to use. This redesign is DNE's commitment to both the customer and the product."

Clearly, DNE has invested a substantial amount of resources into maintaining the AN/FCC-100 for many years to come. DNE won't admit how much they have invested into the redesign, but they do admit they own nearly 90% of the installed point-to-point multiplexer base within the DoD - a base that is still growing. They will say that they are committed to supporting the AN/FCC-100, and will continue to manufacture it as long as there is a demand. Certainly DNE has invested to support such a demand for the AN/FCC-100 for many years to come.

About DNE Technologies, Inc.

DNE Technologies has been a manufacturer of tactical communication products since 1951. In addition to the AN/FCC-100 Multiplexer, DNE manufactures ATM networking equipment for tactical applications, NRZ/CDI/Fiber protocol converters, ISDN extenders, and Auto-Crypto Resync modules. DNE Technologies is an ISO 9001 registered company.



DNE Mux/DeMux card, P/N: 85090150-001, -002, -100, Circa 1984(top) is more highly populated than the newer DNE Mux/DeMux card, P/N: 85090150-202 January, 2003



50 Barnes Park North
Wallingford, CT USA 06492

T (203) 265-7151
T (800) 370-4485 (toll free)

F (203) 284-8414
E info@dne.com

W www.dne.com