

From: Bill Eastham  
To: Michael Gregoryk  
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Subject: Radios

Until a few years ago, the entire college radio system was analog based and working in the 460 MHz business band, licensed under Title 47 - Part 90 of the code of federal regulations. Some of the channels that we are using have been licensed to the college for more than 40 years. At the time that the majority of the college system was purchased, built and licensed, the FCC allowed business band users to employ 25 KHz of deviation. Since our communication is FM (frequency modulation) based, the amount of deviation you are allowed to use is essentially the bandwidth of the radio channel. More bandwidth makes communications sound better and carry further, but it also uses up more spectrum. As an example, our maintenance channel is at 464.825 MHz, this is the center frequency of our assigned channel, but the actual bandwidth of the channel under 25 KHz deviation is 464.8125 to 464.8375 MHz. This is known in the FCC documents as 25 KHz efficiency.

The first major change that happened to our system occurred just before January 1, 2013. This is the date that the FCC mandated that all transmissions in our band (Part 90 frequencies, 421 to 512 MHz) must operate on a 12.5 KHz efficiency. This essentially reduces the available bandwidth for voice communication by 50 percent, and has the potential impact of reducing the area served by our repeaters. The long term goal here is to increase the number of channels available in the limited spectrum for the business band, and this is a necessary impact of trying to create more channels in the same amount of space. Most of the college equipment was moved to 12.5 KHz efficiency through software changes made by our tech (Thom Babich), but some of the older gear could not be reprogrammed and had to be retired. This was a fairly major effort, as every piece of gear on the campus had to be located, assessed and reprogrammed. It was a blessing to have someone in house that could do this work.

It is worth noting that the FCC has proposed moving to a 6.25 KHz efficiency in the future, although no time frame has been established for this change. It is fairly unlikely that any of our current analog radio equipment could be upgraded to 6.25 KHz efficiency, this would require a total replacement of our analog systems.

The next big change in our system also happened around January 2013 when Karen Saldana made me aware of a grant that might be available from ASCIP to improve campus safety. We applied for and received a \$50,000 grant from ASCIP to purchase our first round of digital radios and a digital repeater. You can think of our analog radio system as an old time party line, everyone can listen in and it is pretty easy for anyone with a scanner to eavesdrop. A digital radio system encodes transmissions as digital audio (i.e data) and uses a control channel from the repeater to determine which radios will hear a given transmission. This method of communication is considerably harder (although not impossible) to eavesdrop on, and although it doesn't sound really great, it is VERY efficient, so much so that you can get two complete digital channels within the 12.5 KHz efficiency. This system is also trunked (thanks to the control channel) so that you can setup multiple groups of users that can all conduct different conversations as long as there are not more than 2 conversations at a time. The system also

allows for priorities to be established. Currently, Public Safety is the only user of the digital channels, but when we add more users, Public Safety will have the highest priority, and if all trunks are busy, a transmission from Public Safety will knock a lower priority user off the air for the duration of the transmission.

Because of the control channel, there are a number of additional useful functions that are only available in digital systems. If a radio is lost or stolen, it can be remotely disabled so that it can't be used maliciously. If one of the radios is accidentally transmitting for an extended period, it can be silenced remotely. Under situations of duress, it is possible for an authorized user to remotely trigger the transmit function of a radio so that the situation around the holder of the radio can be determined. With proper software, it is possible to locate the position of all radios in the system via GPS. But most importantly, the digital system gives us twice as many well managed channels with no additional licenses.

In the first round of purchases we acquired around 40 handheld radios and the digital repeater. Subsequently, Public Safety bought a number of vehicle radios that still need to be installed, so we have in the vicinity of 50 digital radios, and all told around 200 analog radios. In addition to the digital repeater, we are licensed for four additional repeater channels, one of which is dedicated to an interface with LA County Fire.

The first batch of radios that we purchased were Motorola XPR 6550 radios. As currently configured, the 6550 requires a number of cumbersome steps to switch between the campus analog channels and the digital channels. The switch requires 6 button presses while looking at the radio display, not easy to do in a hurry. These radios were the best that we could afford when we got the grant. The radios that I specified for upper management are the newly issued CP200D radios, which only require the turn of a dial to switch between the analog channels and the digital channels, so they are much easier to use, especially for occasional users. There is now a firmware update for the XPR 6550 radios that will provide the same functionality on those radios, we are getting a proposal for the firmware upgrade on all of our radios now.

For the future, we should obviously stop buying analog equipment, but to transition from analog FM transmission to digital trunking not only requires new radios, it also requires new repeaters and a repeater control system to unify access to all trunks. We also need to establish an integrated bridge for the campus safety radios to allow communication with LA County Fire, and possibly LA County Sheriffs and Cal Poly Pomona Police. As most recently demonstrated by the DC Metro Fire, the lack of unified communications in a disaster can compound the impact of that disaster rather quickly.

Additionally, we need to establish a better repeater site with better emergency power. The current repeater site is on the roof of Building 28, and it has been subject to occasional power issues. We are beginning to work on the development of a site with Facilities Management, as we are losing the current studio to transmitter link for the campus radio station when the stadium light towers (one of which is also an antenna tower) are taken down as part of the stadium renovation project. The site on the hill just west of maintenance has already had power and data conduits installed as part of the EOC project, we just need to construct a transmitter tower and a transmitter building up there to complete the site.

There are a number of pent up needs for communication that have developed in the past few years. IT really needs a channel for their use, and there are times when Maintenance could use an additional channel. The warehouse could certainly use a channel to expedite deliveries as well. All of these needs could be easily served with an upgraded system.

Please let me know if you need more information.

Bill Eastham

P.S.

As much as I am loath to set up another committee, I would like to briefly convene a group of known and potential users to solicit information on needs for the new system. This group would include:

Dave Wilson - Public Safety and Parking  
Gary Nellesen - Facilities Planning and Management  
Karen Saldana - Risk Management, EOC  
Dale Vickers - IT Operations  
Carolyn Keys - Student Services (Student Affairs, DSP&S, Student Health Services)  
Joe Jennum - Athletics and Instruction Team representative  
William Eastham - Technical Services  
Thom Babich - Technical Coordinator

I would anticipate possibly three meetings:

1. Presentation of current system and digital migration possibilities, develop information required from each area (Late February/Early March)
2. Review of information received from each area, develop channel and equipment plan (2 weeks later)
3. Presentation of digital system design and cost estimates, develop phasing plan (2 weeks later)

Unfortunately, we don't have a good inventory of radios at this point, so one of our first tasks would be to organize the information about what we actually have. We would put all of that information into a SmartSheet for easy access.

Hopefully this schedule would allow us to make some preliminary purchases this fiscal year if funding permits. It will be tight.

Let me know if you would like for me to proceed down this path, and also let me know if there are others that should be included on this list.