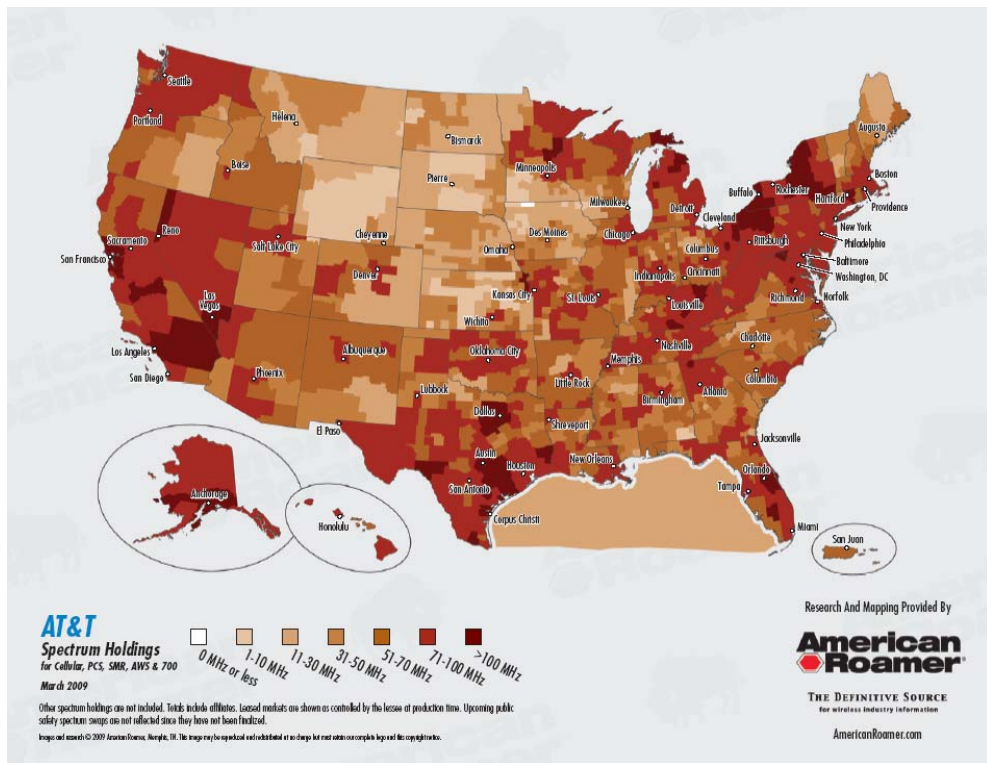
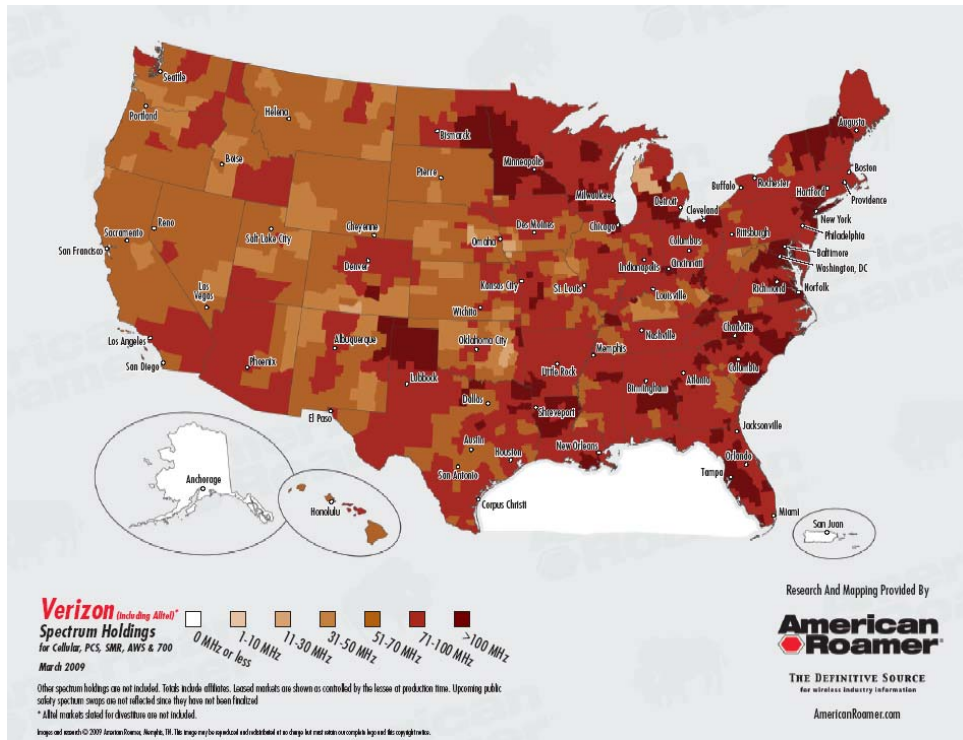


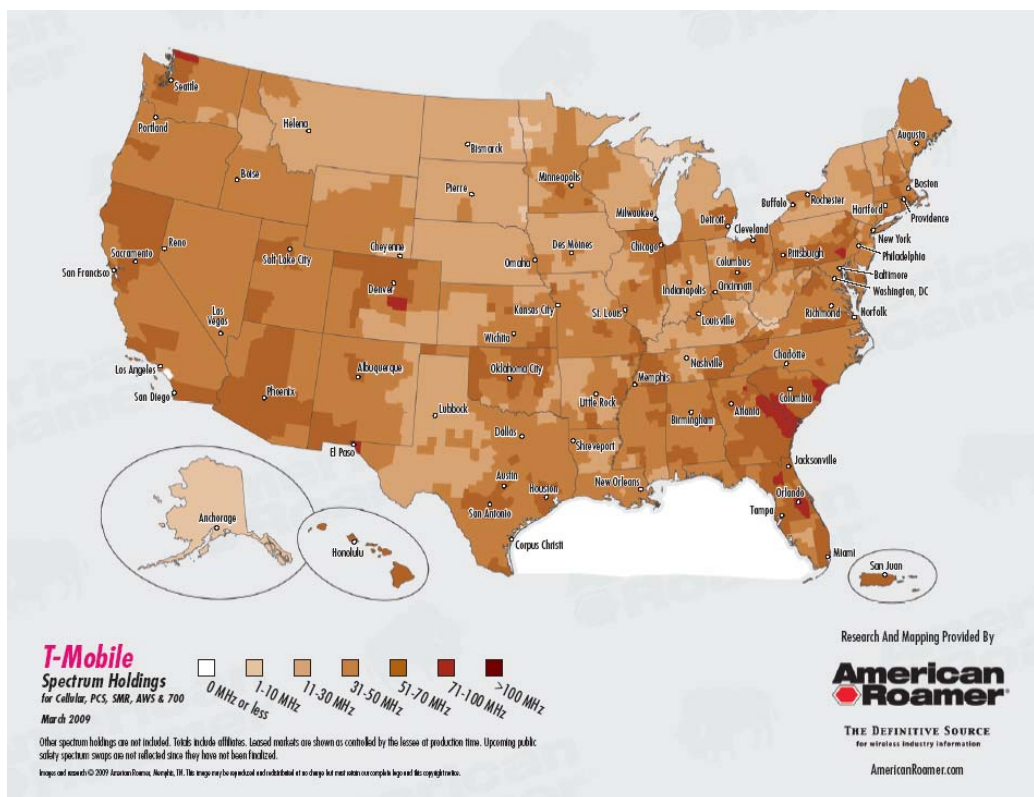
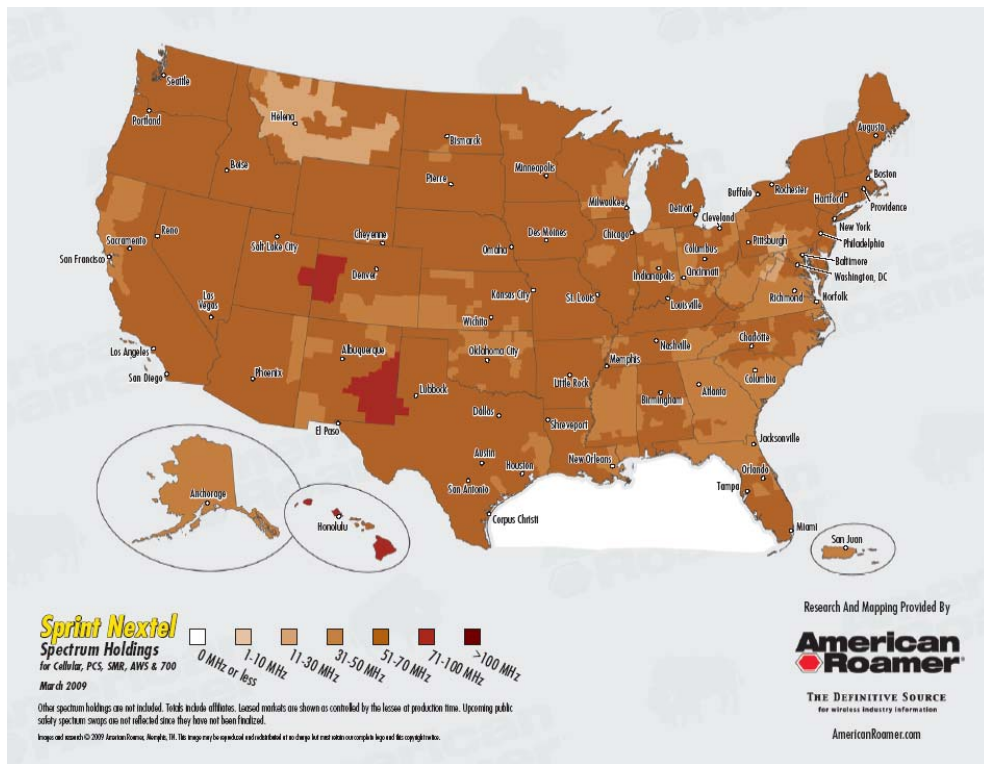
Spectrum, spectrum everywhere, but not a drop to drink?

It always helps in predicting the future, if you first where would 500 MHz of spectrum come from, anyway? ...

The steady drumbeat of the wireless operators that “We need more spectrum” has started to gain traction. With the national broadband plan due out later this month, and with FCC Chairman Julius Genachowski calling for a whopping 500 MHz of spectrum, could the drought be over? Could the FCC, which up to now has been capping the amount of spectrum that licensees can hold suddenly do an about face? And, though 500 MHz is a veritable bounty of spectrum, the CTIA wants more, saying it needs 800 megahertz to stave off a “looming spectrum crisis.” And, finally, with the laws of physics being immutable, spectrum is a zero sum game – so where would 500 MHz of spectrum come from, anyway?

Let’s start with the facts: The bigger two of the big four wireless firms (i.e. Verizon and AT&T) boast spectrum portfolios of about 100 MHz nearly nationwide. Considered by itself, Sprint has significantly less (about 60 MHz though, with about half the customers of AT&T or Verizon, Sprint clearly needs less), but when you throw in Clearwire’s massive 120-140 MHz near national portfolio, Sprint vaults to the front of the spectrum derby. (For completeness, we should also acknowledge that AT&T has significant WCS spectrum holdings that, for reasons described later, are not included in these figures.) T-Mobile brings up the rear of the “big four”, with an average of about 50 MHz. These results are depicted in the four figures below, thanks to the tireless efforts of the folks at American Roamer.







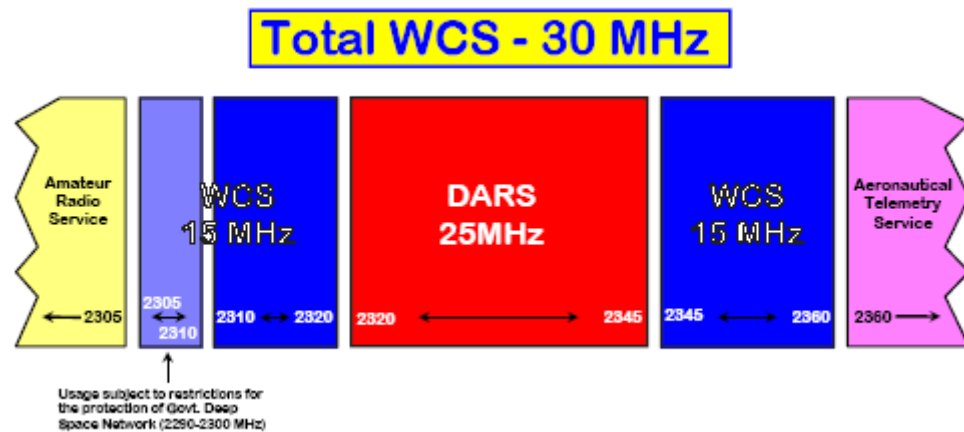
Unlike network hardware, however, spectrum never needs to be replaced!

So now that we know who has it, why do they need it? With voice minutes of use having peaked (thanks to the expanded use of texting), and cellular penetration approaching 100%, it's not because of talk. Rather, exploding data use, especially by smart phone users, is the culprit. In particular, AT&T's network has experienced significant stress due to the wildly popular iPhone with its plethora of bandwidth hungry apps. Additional spectrum reduces the need for additional towers – leading to reduced capex. Thus to an extent, expenditures on spectrum can be traded against expenditures on network hardware. Unlike network hardware, however, spectrum never needs to be replaced!

When considering spectrum holdings, it's important to also consider the value of contiguity (the amount of bandwidth in MHz of the dedicated spectrum blocks that are licensed). For 3G deployments using the WCDMA standard, spectrum chunks of at least 5 MHz in width are necessary for deployment, and while LTE (4G) supports chunks as small as 1.4 MHz, this comes at the cost of reduced spectral efficiency (i.e. capacity per MHz of spectrum). Finally, larger bands of spectrum support faster peak data rates. Given this flexibility, wider spectrum chunks are proportionately worth more than smaller ones, and the regulatory bodies and carriers include this fact in their deliberations.

Due to the potential for co-interference ... and uncertainty regarding the rules to prevent this, the WCS band has remained largely unused.

So where might we dig up more spectrum for the carriers? First, there are significant blocks of spectrum that are already allocated, but underutilized or not utilized at all. One significant block is the WCS 2.3 GHz spectrum, 30 MHz in total, which is directly adjacent to the Digital Audio Radio Service (DARS, or Satellite Radio) band as shown below. Due to the potential for co-interference between these bands and uncertainty regarding the rules to prevent this, the WCS band has remained largely unused. With this knowledge and a pending rulemaking, we expect the FCC to address this issue once and for all – freeing up a significant amount of spectrum resources (much to the joy of folks at AT&T and Nextwave Wireless, the principal holders of these licenses).



With 200 MHz of prime low frequency spectrum being used for TV broadcasting, rebanding all or a portion of this spectrum to wireless use makes a lot of sense...

Another area of underutilized spectrum is the substantial holdings of the Mobile Satellite Service/Ancillary Terrestrial Component (MSS/ATC) operators. Between TerreStar, DBSD and Skyterra these operators control an additional 68 MHz of spectrum in the 2.0 and 1.6 GHz bands that is lightly used. Globalstar has another 23 MHz or so. In theory, the concept of ATC, which relies on terrestrial base stations (i.e. cell towers) to fill gaps in coverage and more effectively reuse spectrum, was intended to stimulate greater use of these spectrum resources. In practice, none of these operators has adequate financing in place to deploy the terrestrial component of their network and the spectrum remains largely unused. In a recent speech, FCC Chair Genachowski intimated that the forthcoming National Broadband Plan will seek to incent the development of these assets, perhaps by allowing incumbents to sell or lease the spectrum and share the proceeds with the government.

With 200 MHz of prime low frequency (700 MHz and below) spectrum being used for TV broadcasting, rebanding all or a portion of this spectrum to wireless use makes a lot of sense. Consider that it's widely assumed that perhaps 10 million households still get their signals with "rabbit ears" and that the last 700 MHz auction netted the taxpayers a cool \$19.5 billion (or approximately \$2000 for each of these households) all while enhancing wireless services for the 250+ million wireless users. Sounds like a win-win to me to go back to this well for a redux – perhaps with some portion of the proceeds dedicated to subsidizing basic cable or DBS service for those affected. As Genachowski noted, perhaps some of the proceeds could even be shared with the broadcasters relinquishing the spectrum to secure their blessing (though with guaranteed carriage



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on cable, fiber and satellite, it's not clear why such a payment is warranted).

reallocation and rebanding of government spectrum also offers the potential for making additional spectrum available for broadband ...

With over 500 MHz of dedicated spectrum below 3 GHz, reallocation and rebanding of government spectrum also offers the potential for making additional spectrum available for broadband. Much as the ongoing Nextel spectrum rebanding effort has increased the amount of contiguous spectrum available to Nextel while increasing efficiency so an intelligent rebanding of underutilized old services offer the potential to free up this irreplaceable resource while improving new services.

Consolidation to a smaller group of carriers helps alleviate this waste – and can still preserve competition if done intelligently. ...

Of course, being investment bankers here at Near Earth, we'd be remiss if we failed to mention the other way to free up spectrum: consolidation! Just as it makes no sense for there to be four rail lines to every town, four (or more) duplicated sets of infrastructure is inherently wasteful – which implies that potential consumer benefits from added competition are squandered on hardware, all the while the public asset is inefficiently used. Not the way to run a railroad... Consolidation to a smaller group of carriers helps alleviate this waste – and can still preserve competition if done intelligently. For example, by allowing T-Mobile and Sprint to merge, and allowing the remaining “big three” to buy up their smaller brethren like MetroPCS, Leap and U.S. Cellular (which have their own underutilized spectrum portfolios) we are left with plenty of competition amongst carriers with enough spectrum to really provide next generation services. Some potential other targets for consolidation include Spectrumco, the joint venture between Comcast, Time Warner Cable and Brighthouse Networks that controls 30 MHz of 1.7 GHz spectrum.

Now some would argue that the current administration in Washington is against consolidation – and perhaps so. But with the right benefits and incentives, we think even the current administration might allow additional consolidation. Consider that with some additional engineering work, and the pending rollout of a unified technology standard (i.e. LTE), dynamic roaming offers the potential for additional benefits. Is your iPhone running slow on AT&T's network? – then roam over to Verizon's where they can hear you now. Not by switching your carrier, but by switching the network infrastructure on a call by call, or even packet by packet basis. Now that's a way to supercharge competition!

In conclusion, we have offered a number of ways to address the ever increasing need for spectrum in the United States. We don't



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know if these ideas or others will show up in the FCC's pending plan, but we think all of them deserve consideration.

By John Stone
Near Earth LLC



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