

Sharing Federal Government Spectrum: Practical Problems & An Alternative Approach

Michael J. Marcus, Sc.D., F-IEEE
Director, Marcus Spectrum Solutions, LLC
Washington DC USA

mjmarcus@marcus-spectrum.com

www.marcus-spectrum.com



11th ANNUAL INTERNATIONAL SYMPOSIUM ON
ADVANCED RADIO TECHNOLOGIES
ISART – Spectrum Sharing Technologies

N3JMM/ 7J1AKO

Changing Spectrum Management

from

“Zero Sum Game” → “Win-Win”

**Alternative
Title**

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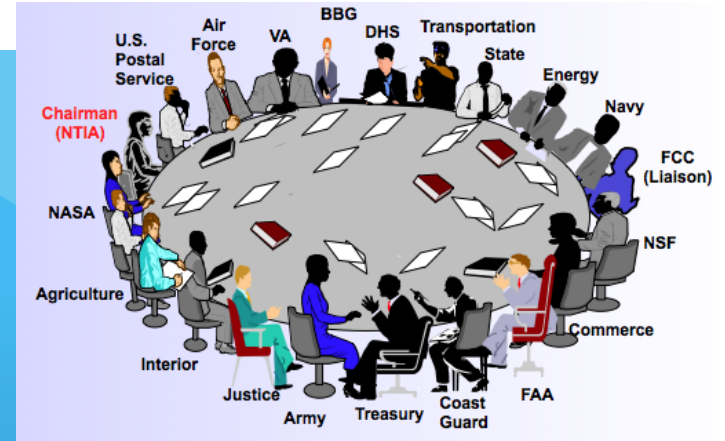
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Key Points

- Federal spectrum management needs serious reform to make its official goals realistic – not hollow promises
- Under present regulatory processes DSA of federal spectrum using passive sensing does not lead to viable business plans
- Urge focusing on cooperative access to federal spectrum with
 - new federal systems designed for sharing
 - **real** Incentives and **timely compensation** for federal agencies to share spectrum
- Proceed on a parallel track with policy reform



IRAC: The *tatemae* and *honne*



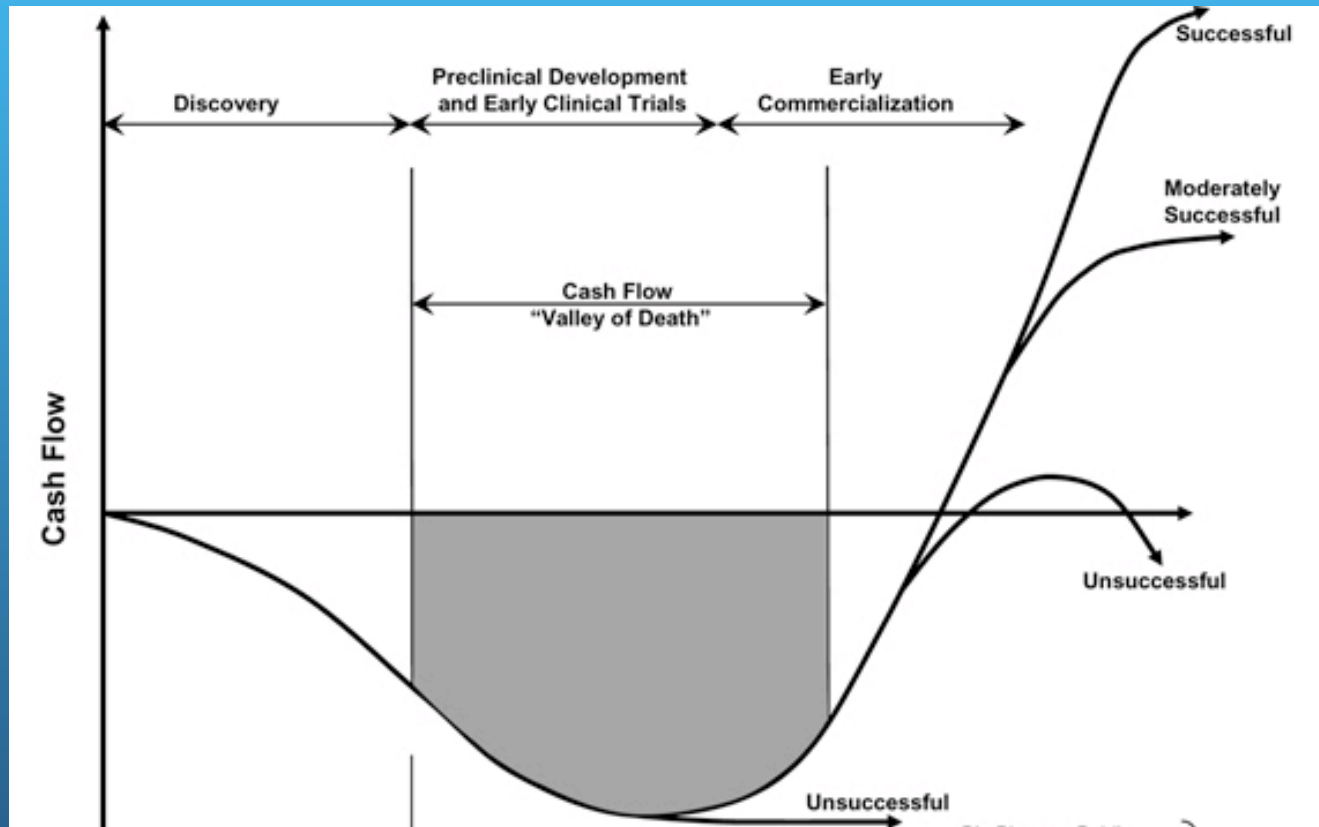
- In the near term the IRAC is the *de facto* major player in determining of whether a DSA proposal has an acceptable interference risk
 - IRAC members work for individual agencies and have primary loyalty to their employer
- In the near term the IRAC has major transparency problems and few incentives to accept DSA for federal bands
- Incumbents are a “tough audience” for DSA proposals

tatemae 建前 = the truth as you want it to appear

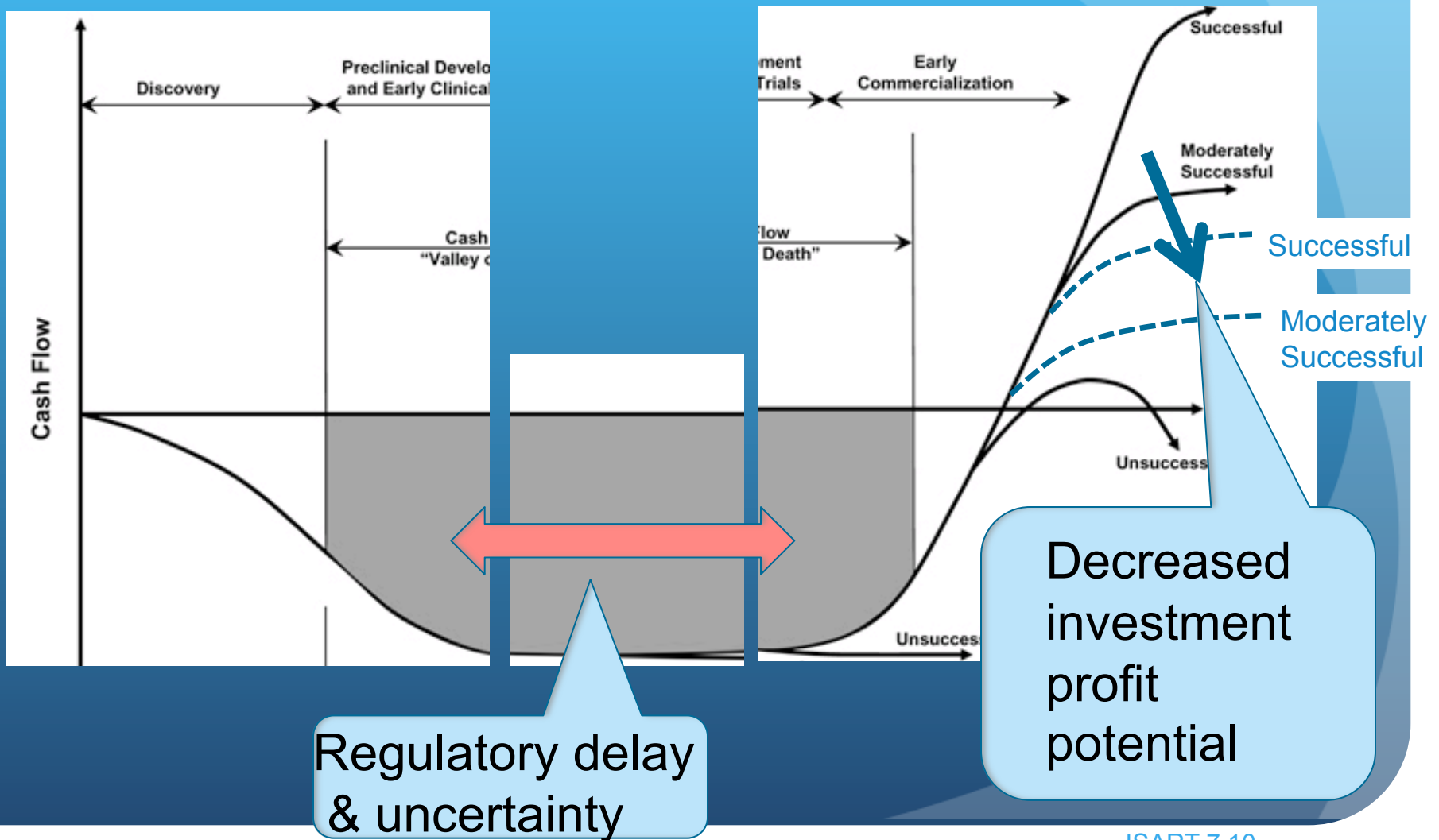
honne 本音 = the truth



Typical Cash Flow for New Product or Service



Impact of Spectrum Regulation on Innovation: "Classic" DSA May Not Have a Viable Business Plan at Present



Need for New Commercial Spectrum

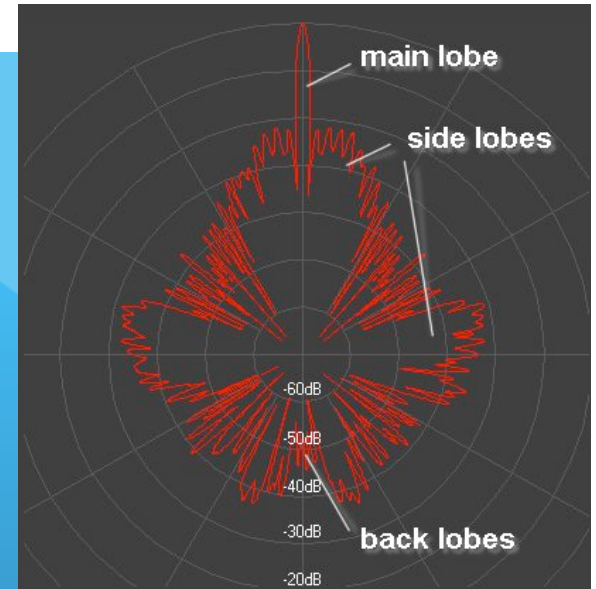
- CTIA requested 800 MHz based on studies that *might* be dated
- FCC, NTIA and White House seek 500 MHz
- Voice minutes are now actually ***decreasing***
- Major growth is in packetized data and is generally asymmetric
- Full duplex paired spectrum with continuous availability was necessary for cellular voice, but
- Much of today's growth *can* be handled with TDD and intermittent availability spectrum – not symmetric FDD

CR: Cooperative Radios

- Implements DSA by explicit communications with primary user so sensing errors are not a question
- Might use European-style CPC (cognitive pilot channel)
- Primary federal user must use new systems designed for sharing
 - Must retain absolute preemption in real time
 - Should be rewarded for new equipment investment as an incentive for cooperation – perhaps even cost+

CR: Cooperative Radios

- Case I: Radar spectrum
 - Major use of federal spectrum
 - Most radars rotate at a constant rate
 - Real radar antennas always have backlobes –
 - Better, usually larger, antennas have lower backlobes but most users have no incentive to decrease backlobes under present policy
 - GPS time distribution allow precise distributed timing and synchronization at low cost
 - Allow access to radar spectrum during part of rotation with new radars with improved backlobe performance
 - Such intermittent spectrum can be used for the growing commercial demand



CR: Cooperative Radios



- Case II Sharing Federal LM Spectrum
 - Maybe *even* Federal aeronautical spectrum (220-400 MHz)
- Treat as “interruptible spectrum” analogous to “interruptible electricity” – a standard practice in the power industry
- Trunked federal systems would enable commercial access to their spectrum on fail-safe basis as well as improved use of present spectrum and OPSEC
 - Protect channels currently in use plus safety margin of addition channels for near term (30-60 s) traffic increase
 - In effect an “unrealizable” sensing system that perfectly measures *both* the present and the near term future
 - Federal users should be compensated for increased cost + as incentive

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- SpectrumTalk Blog
- RF Environment in Action
- Contact: MS



SPECTRUM LINKS

This is a collection of useful links about wireless technology and regulation. At the end are also some travel links about France and Japan where I have lived.

General Information on Radio Technology.
You could do worse than starting with the Wikipedia entries on [Digital Mobile Telephony](#), [Wireless Communications](#), [Internet](#), and [Mobile radio networks](#) (which includes links to discussions of a wide variety of cell phone technologies). I admit to being a Wikipedia fan and contributor, but have had no role in these specific entries.

For links on the topic for nonengineers, I recommend Tomaru's [Electronic Communications Systems](#) (essentially a junior college textbook) and the [IEEE Handbook](#) (intended for radio amateurs, but many parts have general utility and all are straightforward). We used the Tomaru book at FCC as a key part of a basic course on radio technology and policy. A classic, interdisciplinary program, but slightly dated, survey of telecom technology is J.R. Rame's [Signals](#).

A more advanced general reference is [Reference Data for Engineers, Radio, Television, Communications & Computer Systems](#), often called by its original name, the "RT Handbook", finally with a 1984 publication date. [Telecommunications: An Introduction](#) (1999) would seem to be basically out of date. Parts of it are. But this pioneering text from the University of Colorado's telecom program has some good background information and Chapters 2 and 3 on FCC are inspirational.

A great source of links for information on cognitive radio technology and policy issues is [IEEE ICC 4G's Cognitive Radio Information Center](#). In the microwave area, [microwaves.com](#) has a good encyclopedia. [Trends of Modern Wireless Management](#) by three pioneers of modern UK spectrum policy is a very interesting discussion of modern spectrum policy, not the standard CBP approach. Two interesting books from Japanese friends on new technologies that are not written for specialists: [Mobile Millimeter Wave Technology](#) and [New Wireless Networks and Systems in Communication Systems](#).

[Telecommunications Policy](#) - A set of both technology and spectrum policy links from an Australian consultant.

International Telecommunications Union

[ITU web](#)
[ITU web site](#)
ITU generally charges for documents, but the final ITU-R recommendations are free.
[ITU-R documents](#)
Need to find the name and contact information of the telecommunications regulator in Africa? How about a career in Niger? Start your search here: [ITU-ITF Search](#)
[ITU Constitution](#) - A training course on communications policy leaves with a lot of good background information.

General US Spectrum Information

I strongly recommend Ben's book's book, [Wireless Telephony Handbook](#), as a general source of information on US spectrum. It is a 1998 dated book, published in 2001, but most of the information is still accurate. Sometimes copies can be found in book stores, but Amazon has used copies and a download version.

Spectrum Charts
Let's assume you absolutely must have a spectrum chart. I really don't recommend it unless Ben's book, discussed above, is a lot more useful. But here are some options:



If you really need a copy of the NIST-produced US allocation chart, click on the above miniature. You know that I feel that it is confusing and misleading.



• Surf over to web site for more information

• Thanks for the invitation

Questions?