

Adaptive Spectrum Utilization with Software Defined Radios

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Army-Contract MOIE

The logo for the MITRE Technology Program, featuring a stylized graphic of stacked blocks in yellow, orange, and blue to the left of the text.

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Problem

- Radio spectrum is a limited resource experiencing increased demand. New spectrum use technology is needed to utilize the available resources better.
 - DOD operational frequency assignments are becoming increasingly difficult to obtain.
- New technology must address concern about interference to existing users to gain spectrum community acceptance.
 - This requires technical data to address “show-me” concerns.

Background

Radio spectrum

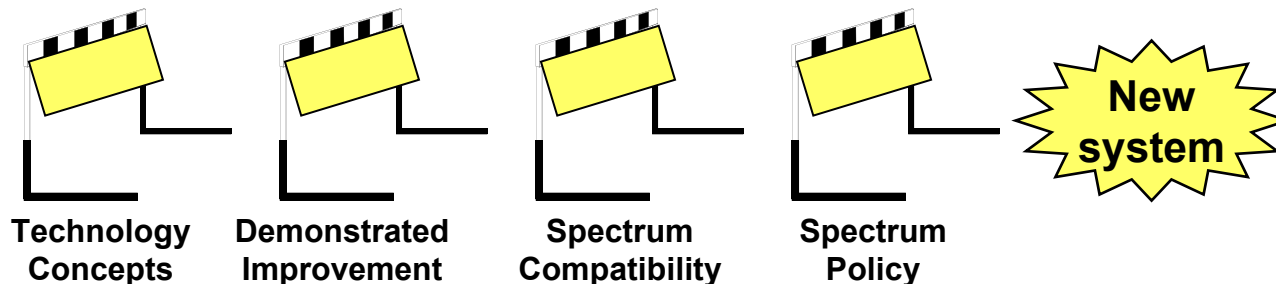
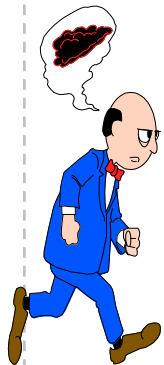


- Finite resource
- Increased competition
- Conservative policy

Technology

- Software defined radios
- Electronic steered antennas
- Compact hardware

Goal: Efficiently use spectrum 100% of time
➔ **Adaptive Radio Technology**



Hurdles to Fielding of New Systems

Objective

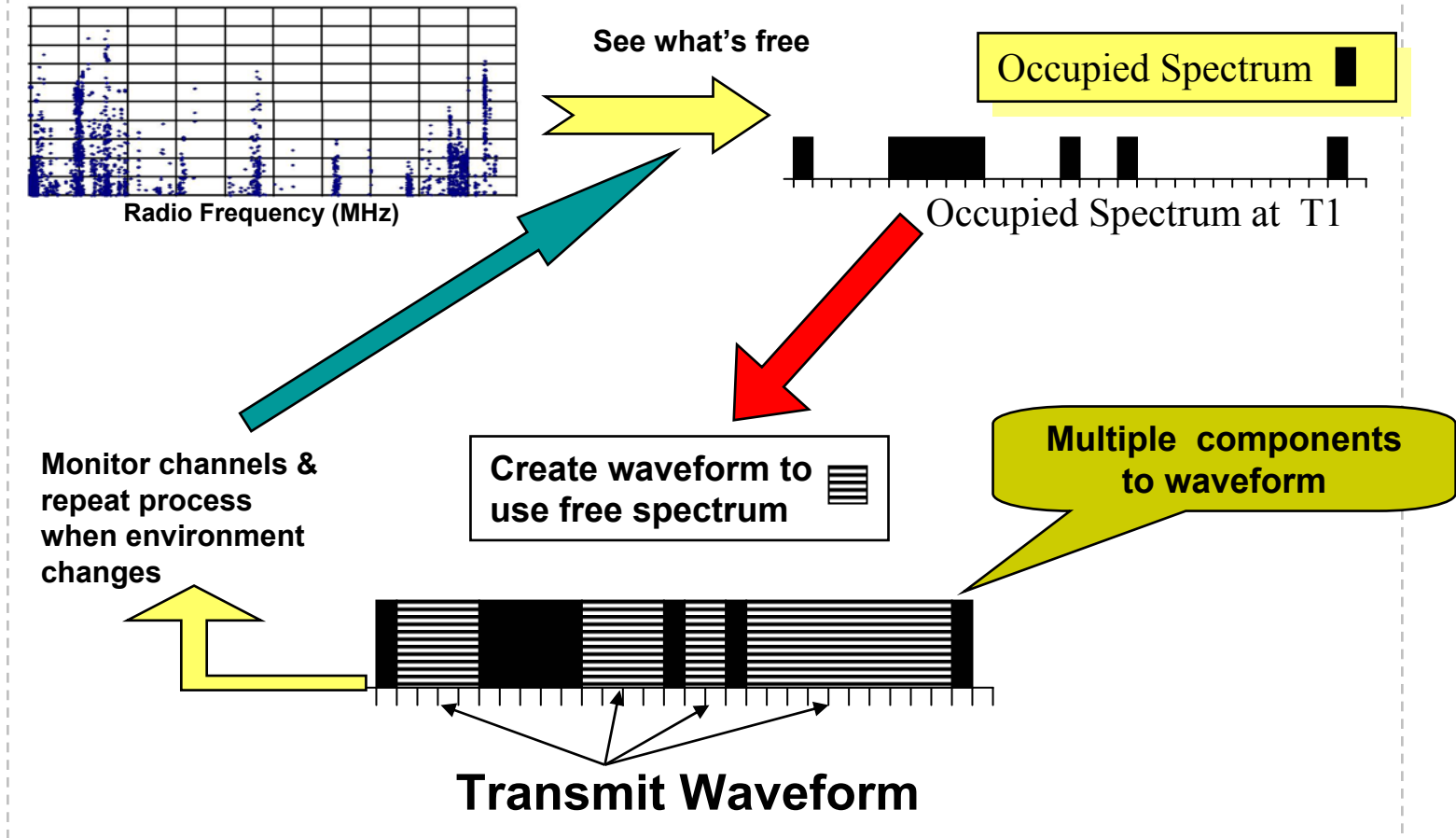
- **Develop Adaptive Radio Concept and examine performance bounds**
 - **Minimize required control infrastructure**
 - **Operate by sharing already assigned spectrum (primary users) and do not interfere!**
- **Use Software Defined Radio implementations to sense radio spectrum and create waveform to match the available spectrum**
- **Develop acceptance of Adaptive Radio Concepts**
 - **User and spectrum regulatory/policy communities**
 - **Demonstrate increased data capacity**

Activities

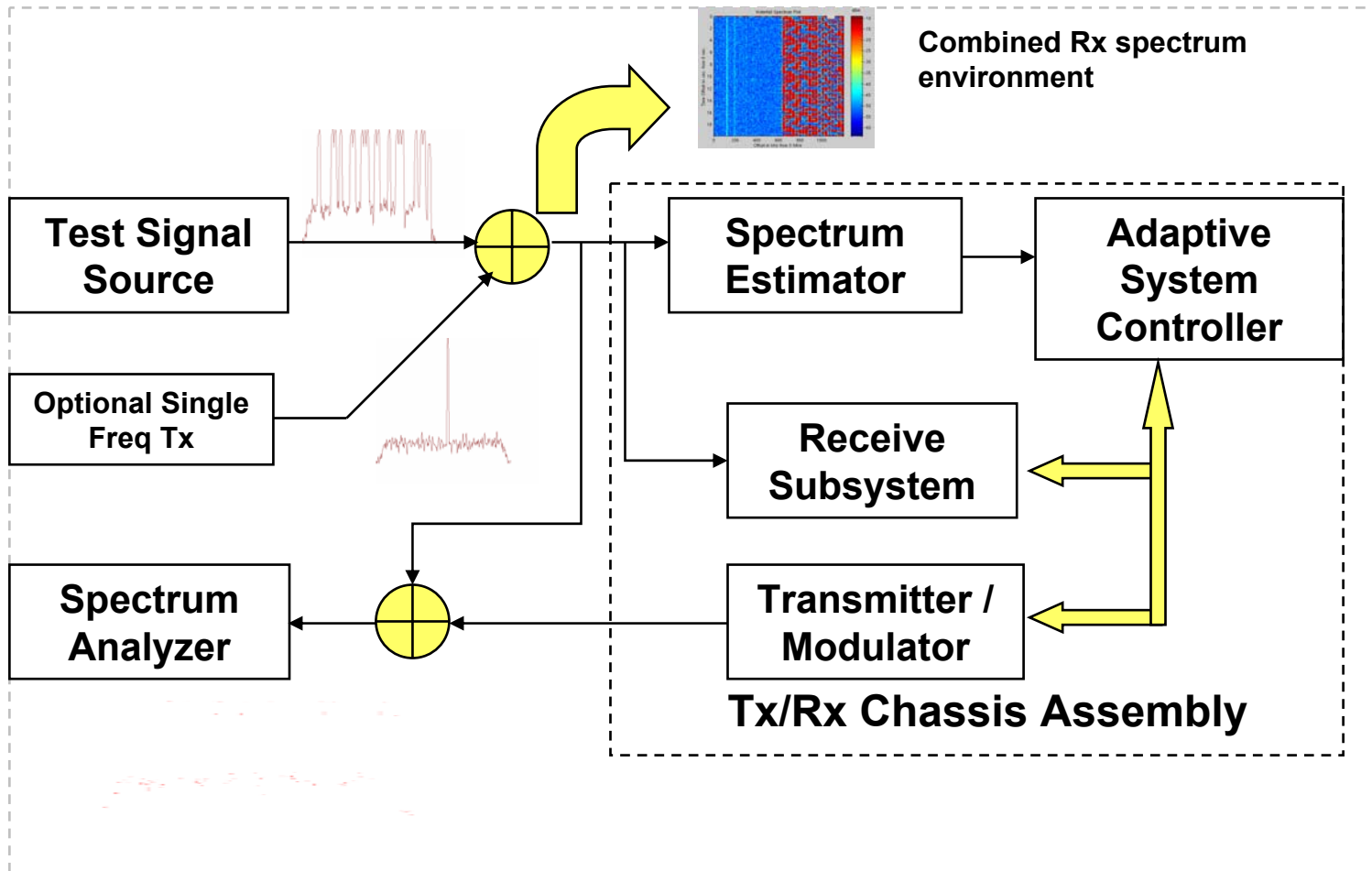
- **Develop Adaptive Radio System Architecture**
- **Identify performance bounds**
 - **Spectrum sensing, interference mitigation, waveform adaptation rates, network protocols**
- **Evaluate improved user data capacity versus spectrum activity**
- **Investigate extent to which spectrum is available for use by the adaptive radio**
 - **Not all assigned spectrum is used 100 % of the time.**

Highlight: Operational Concept

Not all spectrum used 100% of time



Demonstration: Adaptive Waveform



Impacts

- Provides method for sharing for already assigned frequency spectrum
- Implementation results in minimal or no interference to primary users
- Requires minimal preplanned frequency coordination to deploy
- Potential application for homeland defense and FCS applications

Future Plans

- Transition work to government program activities
- Enhance control infrastructure
- Add directional antennas
- Enhance connectivity by network relay
- Model operational scenarios

