# CONSIDERATIONS IN AJ SYSTEM DEVELOPMENT, OPERATION AND DEFINITIONS

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## ABSTRACT

The conventional communication system is designed to work over a worst-case propagation environment with sufficient performance so that the probability of mission success is cost-effectively achieved. Conventional systems have been in a state of evolution and refinement since the early part of the 20th century. Their anomalies are well known. The jam-resistant communications system, however, with additional emphasis on low probability of intercept and exploitation (LPI, LPE) present a whole new list of uncertainties that affect deployment, operation and definitions of what AJ and LPI are in terms of performance against propagation anomalies, the jammer and the intercept system threat.

This paper evaluates the impact of deployment as a technique to minimize the jammer. The jammer through mobility can concentrate their resources as desired. The AJ communication must be capable of adapting. The advantage of deployment through the relay of opportunity to minimize jammer effectivity is illustrated.

The propagation advantage of the spread spectrum signal is emphasized in terms of the anti-multipath correlation properties of direct sequency pseudo-noise and the frequency diversity of frequency hopping. The jammer is denied these properties and must use brute force to minimize fading losses in order to disrupt communications.

The sensitivity of most spread spectrum signals to detection is evaluated. Note that detection criteria can be based on the detection of a small percentage of the signal whereas communications reliability is based on the detection of a high percentage of the signal. The advantage of the intercept system is described with the emphasis on accepting detection as an operational risk that one must live with.

A definition of AJ is proposed that permits the simple comparison of different systems in the presence of barrage noise jamming. Examples of binary and M-ary techniques are presented which illustrate that processing gain in terms of WT cannot be exceeded where W is occupied bandwidth and T is the information binary bit period.