WHITE PAPER

PLATH SIGNAL PRODUCTS

INTERCEPTION CONFIDENCE · DIRECTION FINDING ASSURANCE

High Resolution Methods for Direction Finding

1 The Need for High Resolution Direction Finding

One of the most important functions of an ESM (Electronic Support Measures) or a SIGINT (Signal Intelligence) system is the geolocation of the intercepted emissions. Knowing the location of an emitting target is essential for several purposes. First and foremost, it indicates the location and disposition of forces. Second by clustering different types of emissions in given areas it can also give an indication of the composition of forces. Since the function of direction finding is an essential element in ESM or SIGINT it is the geolocation of emissions that is of particular interest. Two or more (mostly three) line of bearings assumed to be emitted from the same target and measured almost at the same time will intersect at more or less the origin of the emission.

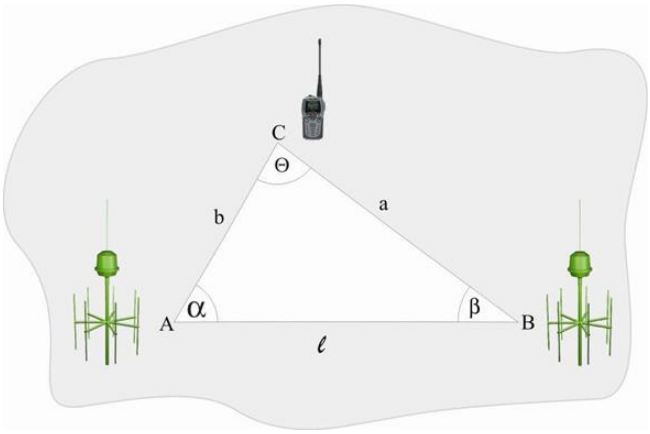

Figure 1: Geolocation of an emitter: the first DF at site A and the second DF at site B determine the bearings of an unknown emitter at site C

Another possibility is to measure the time of arrival of the signal at different sensors. The difference of the interception time – often referred to as the time difference of arrival and abbreviated TDOA – directly relates to the range difference from the emitter to the different sensors, which in turn is taken to compute the position of the emitter.

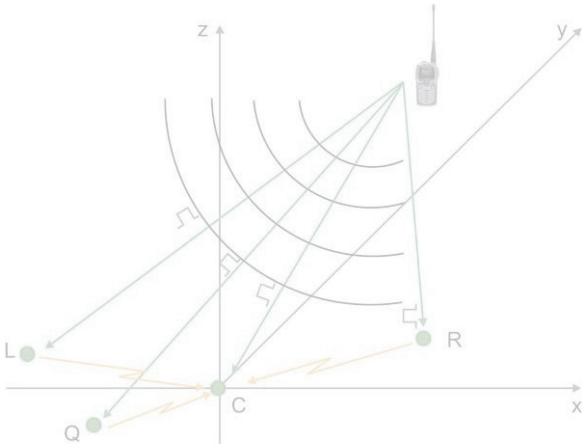

Figure 2: Principle of operation for TDOA

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Although the geolocation of the emitter is an essential element in ESM or SIGINT we will first and foremost focus on the [illegible] direction-finding methods. These are the prerequisites for an exact location. This paper discusses especially high-resolution direction-finding methods in the context of their typical use-cases.

2 Use Cases for High Resolution Direction Finding

To determine bearings to the signal emitters we can rely on principles like Watson-Watt antenna array or correlative interferometry. From those bearings (using triangulation) we may determine the geo-location of the emitter. The geo-location of the emitter is important information, especially in the establishment of fundamental knowledge, which feeds information to military decision makers on every level. Additionally, geo-location of the emitters in tactical scenarios brings unquestionable benefits to tactical operation. But how reliable is the geo-location computation if more than one signal occupies one frequency?