ESTIMATION OF SAMPLING REQUIREMENTS
FOR TRACK-TYPE REMOTE SENSING SURVEYS

PAUL E. ANUTA AND CLARE D. MCGILLEM
The Laboratory for Applications of Remote
Sensing, Purdue University, West Lafayette,
Indiana, 47906

Many types of remote sensing measure-
ments are made along lines or tracks over
the earth's surface which are spaced at
distances governed primarily by assump-
tions about the nature of the phenomena being
measured and cost considerations. In
gyrophysical surveys, aircraft-borne magnet-
ic, gravity, gamma ray, electromagnetic
and other sensors are flown at low alti-
tude with approximately parallel line
 spacings ranging from ½-mile to several
miles. These measurements are commonly
sampled and digitized at an arbitrarily
high rate along the flight path generating
an adequately sampled record with respect
to the Nyquist rate which is governed by
the bandwidth of the physical phenomenon
being observed. The sampling interval in
the across track direction is the track
spacing and closely spaced samples there
would be extremely costly to obtain be-
cause of the increased number of flight
lines required. The research discussed
in this paper addresses the problem of
determining the sampling requirements for
proper representation of the geophysical
fields and is based on study of the power
spectral density of the measured quantities.

The primary object of the measure-
ment of various geophysical phenomena in
exploration for minerals and petroleum
deposits is to locate anomalies in these
variables which may relate to "targets"
of economic value. The spacing of survey
lines has an important impact on the
ability to reconstruct the measured surface
and subsequent detection of anomalies. A
method of selecting line spacing is dis-
cussed, in which the along track spectrum
is used to predict the across track fre-
quency content of the "scene" using certain
assumptions on the isotropy of the fields
of interest. Comparisons will be shown
of spectral estimation using classical
windowed periodogram and autoregressive
methods. Analysis results using data
from analytical models and real data from
U.S. Energy Research and Development Admin-
istration airborne geophysical surveys will
be presented.

The research described in this paper was
supported by the National Science Founda-
tion under Grant ENG-7614400.

1977 Machine Processing of Remotely Sensed Data Symposium