



Name : ACS-MR-ICD-1.1
Release: 1.1
Date : 14/12/1999

Project	MRI Processor
Title	Format Specification Version 1.1

	NAME	DATE	SIGNATURE
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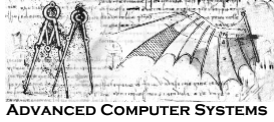
DOCUMENT STATUS SHEET

ISSUE	DATE	PAGES	OBSERVATIONS
1.0	5/10/1999		First Version
1.1	14/12/1999		Calculation of intensity corrected



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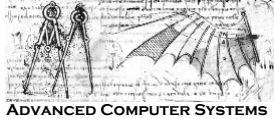
1. INTRODUCTION

1.1 SCOPE

This document describes the data format of the MRI product. .

1.2 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

SAR	:	Synthetic Aperture Radar
MRI	:	Medium Resolution Image



2. GENERAL

2.1 INTERPRETATION

The Medium Resolution Image is a detected multilook ERS SAR image. The image has a pixel spacing of 75m. The radiometric resolution is greater than 40 effective looks. The geometric resolution is less than 150 m.

It is in a zero doppler, ground range projection. The image has been resampled from the natural SAR pixel spacing using a nearest neighbour technique. All pixels which would lie in beam centre (ie-20.355 degrees offnadir angle) if they were on the ellipsoid surface are placed in the same column in the output image. All other columns contain pixels at constant ground range distances from the reference column calculated according to the local ellipsoid arc.

The image lines are ordered from north to south. The image columns are ordered from east to west. In the annotations the localization of the 1st pixel of the 1st line is indicated as lat_UL , lon_UL (upper left longitude and latitude). The last pixel of the last line is thus lat_LR, lon_LR (lower right).

A function based on the arctangent has been used to code the SAR intensity in 1 byte per pixel. The value of each pixel x can be converted back to intensity using the following expression:

$$\text{intensity} = \tan(\beta) + \tan(x(\pi/2 + \beta)/256 - \beta)$$

where, $\beta = \text{ByteBias} \cdot \pi/2 = \pi/4$, with the current configuration parameters.

If we know the calibration constant K for a reference incidence angle α_{REF} and the local incidence angle α we can also calculate the radar backscattering coefficient σ_0

$$\sigma_0 = \text{intensity} \cdot \sin \alpha / (K \cdot \sin \alpha_{\text{REF}})$$

The calibrated intensity ($\sigma_0 / \sin \alpha$) is also called the radar brightness β_0 .

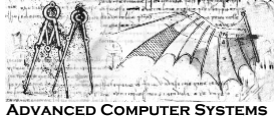
3. FORMAT

3.1 NAMING CONVENTION

An example of a product name is ER2S-_012000_2547_2547_FS_MRI---T.TIF

where:

Mission Identifier	3 characters	"ER1", "ER2"
Sensor Identifier	1 character	"S" (for SAR)
Mode Identifier	1 character	ERS-1: "A", "B", "C", "D", "E", "F", "G" ERS-2: "-" (not relevant)
Separator	1 character	" "
Orbit	6 digits	(with leading zeroes)
Separator	1 character	" "
Frame Start	4 digits	(with leading zeroes)
Separator	1 character	" "
Frame End	4 digits	(with leading zeroes)



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Separator	1 character	" "
Station Identifier	2 characters	"FS" = Fucino, "MS" = Maspalomas, "KS" = Kiruna, "MA" = Matera
Separator	1 character	" "
Product Type	6 characters	"MRI—"
Format	1 character	"T" = TIFF
Extension separator	1 character	" "
Extension	3 characters	"TXT" = Header, "TIF" = Image

3.2 THE MR IMAGE FILE (MR.TIF)

The MR image file is produced on disk in TIFF format. As tiff allows many different formats a very simple format has been used which can be read even without knowing anything about tiff. The image data is written sequentially, 1 byte per pixel, line by line, starting from byte 9. The first 8 bytes of the file contain, according to tiff specifications, the tiff magic number and the pointer to all the tiff structures which are located at the end of the image data. The image dimensions are given in the ASCII annotations (MR_columns, MR_lines) as well as in the TIFF tags.

3.3 THE MR ANNOTATION FILE (MR.TXT)

The MR annotation file is an ASCII file written in a format which is easy to read for both man and computer. The file is organized in sections and contains 3 different types of entries: comments, section headings and field entries. Section headings are simply section names contained in square brackets. Field entries are composed of a field name followed by an equal sign and a field value. Both field and section names don't contain any spaces. Section names are unique within the file and field names are unique within the section. There is only 1 field or section entry per line. Anything on a line after a double slash can be regarded as a comment.

Sections contained in the annotation file are:-

Version section including:
 information on the program version which generated the data

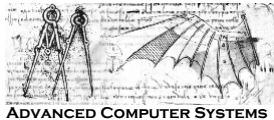
configuration parameter section including:
 a copy of the input parameters

data section including
 sensor acquisition information
 localization information
 image size

3.3.1 EXAMPLE OF AN ANNOTATION FILE

```
[Version]
date="Aug 2 1999_18:30:42" //MR compilation date
path=/disk76/mica/src/insarQL/MR/bin9 //MR installation path
```

```
[MR.conf]
AntennaPatternCorrected=1 //AntennaPatternCorrected 1=>yes 0=>no
AzFilterCoef=.75 //0.54 => Hamming
```



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```
AzFilterSF=.7 //( < 1 ) => undersampling
AzPixelSize_m=75 //Azimuth Pixel Size in m
ByteBias=0.5 //0 <= ByteBias < 1
ByteConvFunc=3
BytesPerPixel=1 //1=>byte 2=>short
DwLines=1024 //Subsampled lines processed per strip (use 2048)
ERS1Gain=1.0 //extra gain for ERS1
ERS2Gain=1.6 //extra gain for ERS2
EstimateDC=automatic //automatic or Doppler Centroid (Hz/2PRF)
Gain=6.0E-8 //gain used to rescale float image to short
InSlantRange=0 //InSlantRange 1=>yes 0=>no
RangeRef=847 //SlantRangeRefForRangeCompensation km
RangeSpreadCorrected=1 //RangeSpreadCorrected 1=>yes 0=>no
RefOffNadir_deg=20.355 //RefOffNadir_deg Reference OffNadir angle
RgFilterCoef=.75 //0.54 => Hamming
RgFilterSF=.7 //( < 1 ) => undersampling
RgPixelSize_m=75 //Range Pixel Size in m
Samples=5616 //Raw samples processed
SamplingErr_pix=.125 //( .5 ) => nearest neighbour
ScrapLines=25 //Lines to be scrapped from start & end of processing strips
Squared=1 //Squared (Intensity) 1=>yes 0=>no
nAzWeights=1 //Azimuth resampling filter size
nRangeWeights=1 //Range resampling filter size
```

[Data]

```
AcquisitionDate = 970806
AcquisitionStart = 09:57:31.585
SatelliteMission = ER2 // ER1=>ERS1 ER2=>ERS2
Sensor=S
SensorMode=-
Orbit = 12000
FrameStart = 2547
FrameEnd = 2547
ProductType = MRI--
ProcessingOptions = -----
AcquisitionStation = CA
AscendingFlag = 0 // 0=>Descending 1=>Ascending
Heading = 12.989562 //deg
lat_UL = 53.016624
lon_UL = 14.275180
lat_UR = 52.804680
lon_UR = 15.794914
lat_LL = 52.133765
lon_LL = 13.959574
lat_LR = 51.923728
lon_LR = 15.449962
lat_centre = 52.472225
lon_centre = 14.870056
MR_columns = 1400
MR_lines = 1342
```