THE AUTOSTAT RASTER DISPLAY

by

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1. Summary

To aid forecasters to make better use of visible and infra-red image
data from meteorological satellites a mini-computer system has been
installed at Bracknell with outputs to TV display, facsimile recorders,
and, if required, a 35mm film archive (via magnetic tape). The
facilities available to control the various outputs are described,
with emphasis on the TV display.

2. Sources of data

a.   Data from meteorological satellites are received by the ground
station operated contractually for the Royal Aircraft Establishment
and the Meteorological Office by Spembly Ltd. at Lasham, Hants.

b.   At present (October 1981) image data are acquired from:

    i.   US polar orbiting satellites NOAA6 and NOAA7 when the
          satellites are within range of the ground station.

    ii.   ESA geostationary satellite METEOSAT 2.

    iii. US geostationary satellite GOES-E (located at 75 degrees
          west).

c.   The image data are passed to Bracknell from Lasham using two
private circuits. One line is used for data from the polar orbiting
satellites and the other for the data from the two geostationary
satellites.

d.   Both analogue (low resolution) and digital (high resolution) data
are received at Lasham from the polar orbiting satellites. The
analogue data are transmitted to Bracknell as they are received. Some
of the digital data are recorded and a picture covering the British
Isles is transmitted in an analogue format (similar to the analogue
data) after the analogue data.

e.   From the geostationary satellites only WEFAX data are received.
Most of the data from METEOSAT 2 is transmitted to Bracknell; when
required,data from GOES-E are transmitted, sometimes recorded and
sent later.

3.   Processing of data at Bracknell

a.   At Bracknell, the data are digitised (to 8 bits) and stored in a
PDP 11/60 mini-computer (see figure 1) which is programmed to
accomplish the following tasks:

    i.   Digitise and store selected data. There are schedules held
in the computer which are used to select which data are to
be acquired, which files they are to be stored in and what
action, if any, is to be taken on the data.

    ii.   Select pictures for output to facsimile recorders (see
para. 4).

    iii.   Manipulate the grey scales to improve contrast and output.
For each satellite, there are 26 tables in the computer for
each output device which are used to convert different
pictures to a similar level before output. Different tables
are used for different areas and times of day. These tables
are changed throughout the year to correct for changes in
satellite contrast levels, particularly at the equinoxes.
Each table consists of 256 bytes, 1 byte for each possible
digitised value.

    iv.   The pictures from the polar orbiting satellites can be
projected onto a polar stereographic projection at a scale
of approximately 1:20 million. These gridded pictures are
assembled as a composite picture containing output for 2, 3
or 4 consecutive passes.

    v.   The pictures are stored on disc for periods of between 1
hour and 24 hours. The actual storage time depends on the
requirements of the forecasters, particularly in the Central
Forecasting Office (CFO) where there is an interactive
display system (see para. 5).

b.   This system is based on a system developed on a PDP 11/40 which
is described in more detail in Wiley and Ponting (1977), and Ponting (1978).
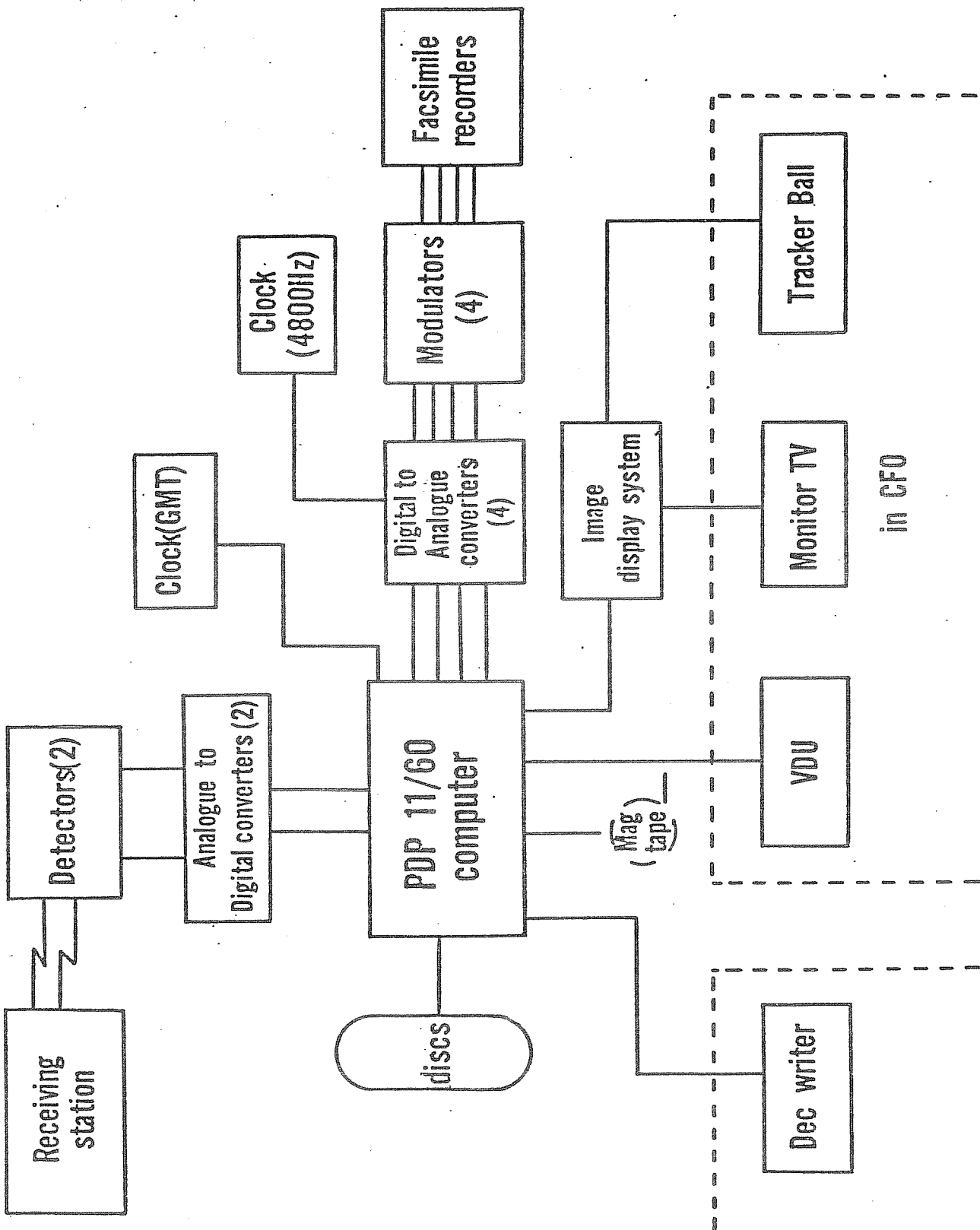
Fig. 1   AUTOSAT

4. Distribution of facsimile output from AUTOSAT

a. Products from Autosat are distributed on a network (SATFAX) of British Telecom private circuits and displayed on facsimile recorders at the receiving stations.

b. There are 4 independent outputs from AUTOSAT. The major Meteorological Offices (except CFO) are all connected to the same channel which contains the greatest number of products. There is a channel which is dedicated to output for CFO, another for output for forecasters at the BBC and the fourth is for the remaining Meteorological Offices on the SATFAX network.

c. Any data can be output on any required channels, the output is queued with various levels of priority. The operators can ask for repeats when required; they can also send administrative messages and schedules.

d. The output can be manipulated as required:

    i. As received.

    ii. Enlarged by repeating points and/or rows.

    iii. Any section can be selected.

5. TV display

a. In CFO there is a VDU from which the forecasters can control a display system and associated TV screen. There is also a tracker ball which is used to position a box on the screen. The coordinates and size of the box can be read and it is used as an aid to setting up sequences of pictures and to enlarging selected areas. The display system can store up to 12 pictures on an analogue video disc. These pictures can be displayed in any required order.

b. From the VDU, there are 5 main groups of commands controlled by questions:

    i. Write a picture to the display store. Any data which have been digitised can be written to the analogue disc; all or any part of the pictures can be written and enlarged as required.

ii.   Display any picture. Any of the 12 pictures which have
       been written can be displayed on the TV screen. The
       forecaster can set up a sequence of up to 20 pictures
       and, if required, ask for the sequence to be repeated.
       The time interval between pictures is selected by the
       forecaster (minimum 0.2 of a second). In practice, an
       interval of 0.5 to 2 seconds is used.

iii.   Information. The forecaster can ask for a list of which
       data are available; this list can be all the files or any
       part (determined by the initial letters of the file name).

iv.   Request facsimile output. In addition to the scheduled
       output a forecaster can ask for pictures to be output to
       the CFO facsimile recorder (see para. 4).

v.   Change grey scales. The grey scales discussed in para. 3
       used to output the display system or to the CFO facsimile
       recorder can be changed from the VDU.

6.   Discussion and Conclusions

a.   The use of a computer to control satellite image data is
flexible and allows a great variety of data to be processed. The
output can be a standard format with standard grey scale levels which
saves having to adjust the recorders.

b.   The use of a display system in CFO has drastically reduced the
output of facsimile pictures required for CFO and gives faster access
to required pictures. When it is necessary to interpret the large
number of pictures which are received from geostationary satellites,
the display system allows a sequence of pictures to be set up (e.g.
the last 6 hours covering the area around the British Isles).

7.   References

Wiley, R.L. and Ponting, J.F., 1977: Real time processing of image
                    data from satellites under RSX 11D. Proceedings of
                    the Digital Equipment Computer Users Society, 4,
                    No. 1, pp 141-146.

Ponting, J.F., 1978: Computer processing of satellite image data.
                    Met. Mag., 107, pp 272-277.