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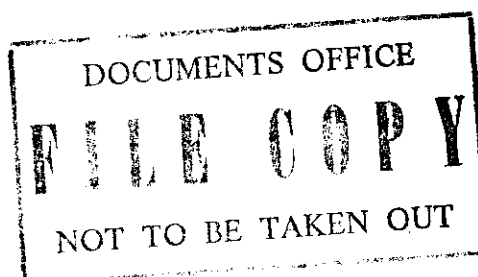
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**NEW MAPS FROM OLD - GRIDDING
THE SEYCHELLES OUTER ISLANDS PHOTOMAPS**

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**NEW MAPS FROM OLD -
GRIDDING THE SEYCHELLES OUTER ISLANDS PHOTOMAPS**

by

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SUMMARY

This paper describes a task that might appear unremarkable but which, in fact, was quite unusual and may have applications in other island states. The Seychelles Government required that the uncontrolled photomaps of its south western islands be placed on WGS72 Datum and gridded, in connection with the definition of the Seychelles' Exclusive Economic Zone. The construction of the original photomaps, the Doppler survey and the application of UTM grid to the Edition 2 photomaps are described.

1. INTRODUCTION

It is not unknown for maps to be republished on a new datum and grid, e.g. from astro datums and local grid to North American Datum 1927 and Universal Transverse Mercator (UTM) Grid in the Caribbean, but it is out of the ordinary for azimuth and scale changes to be applied to uncontrolled maps during the gridding process. The Seychelles Government requested in 1992 that the photomaps of its south western outer islands be placed on World Geodetic System 1972 (WGS72) Datum, UTM grid, for the purpose of defining the boundary of Seychelles' Exclusive Economic Zone (EEZ). The islands in question were Aldabra, Assomption, Astové, Cosmoledo Group, Farquhar Group and Providence Group. All the photomaps were uncontrolled except for Aldabra which had been surveyed by the Seychelles Survey Division (SSD) and the Royal Navy (RN).

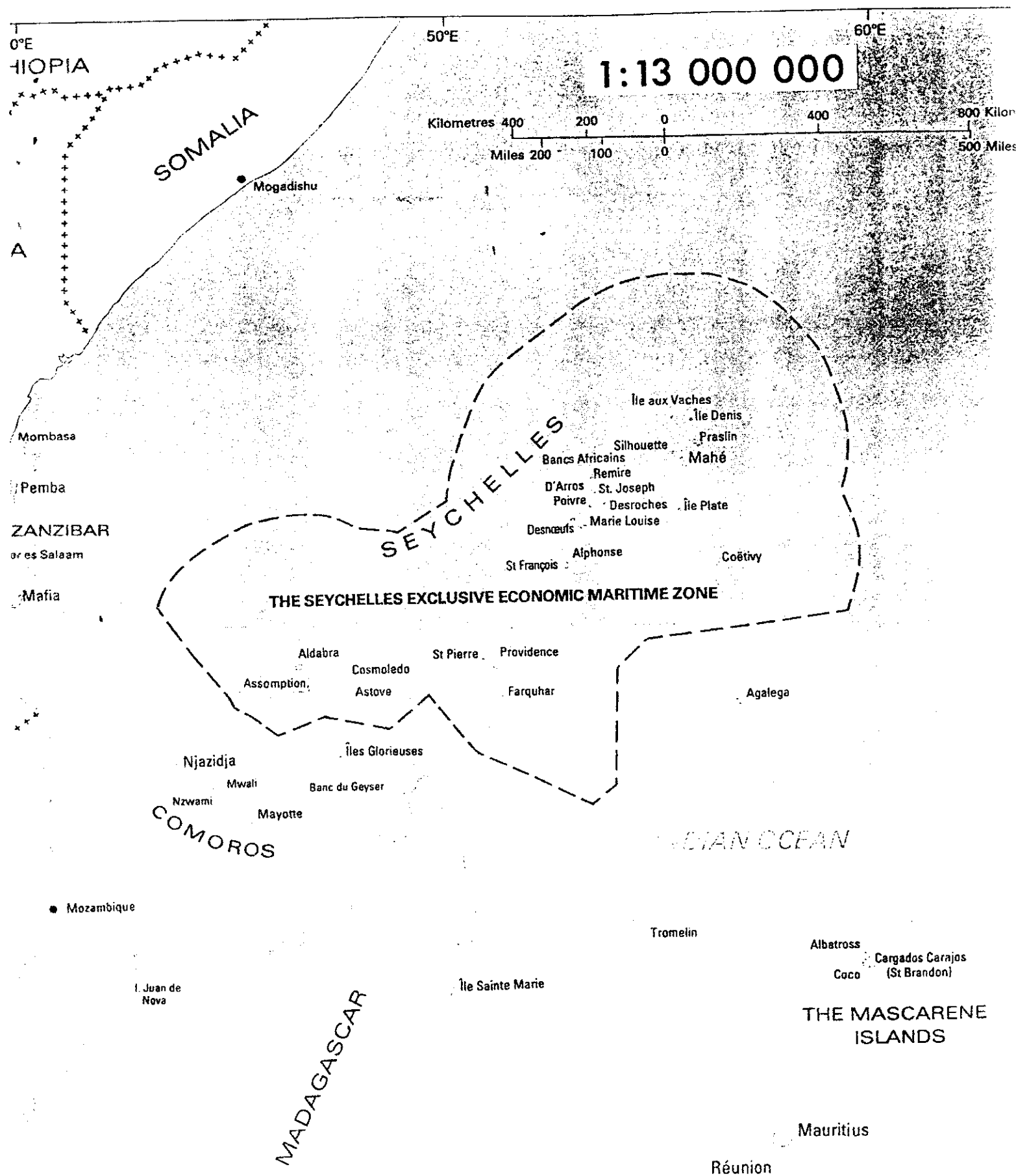
2. THE PHOTOMAPS

2.1 The Seychelles Government requested assistance in the production of a series of 1:25 000 to 1:5000 photomaps of all its outer islands (except Aldabra, which had been mapped already) in 1975. The maps were required for land registration, valuation and rating, and planning in tourism, fishing and communications. The islands, and island groups, concerned were (from east to west) Coetivy, Platte, Bird and Denis, the Amirante Islands, Alphonse, Farquhar, Providence, Astové, Cosmoledo, Assomption and Aldabra. (See location map.) Control surveys by conventional and Doppler methods had been carried out in the more easterly islands - Coetivy to Alphonse - by the Directorate of Overseas Surveys (DOS, predecessor of OS International) and the Royal Engineers. The maps of those islands could, therefore, be constructed on UTM grid, WGS72 Datum. The more westerly islands - Farquhar to Aldabra - would have to be uncontrolled and based on local astronomical datums.

2.2 The photography available in 1975 had been flown for DOS by Spartan Air Services in 1960, and by the Royal Air Force and Royal Navy in 1971. In the islands where ground surveys were absent, geographical position, azimuth and scale were taken from Admiralty Charts and scale checked against air photos. The islands of Assomption, Cosmoledo and Astové were theoretically on Aldabra astro datum, having been tied together by a Royal Navy taut-wire traverse in 1962. The Providence and Farquhar Groups were fixed by RN astronomical observations in the late nineteenth century.

2.3 The chart orientation of Assomption was known to be some degrees in error. The true orientation of the island was checked by using the solar reflection on an air photograph: knowing the time and date of exposure, the sun's altitude and azimuth were computed, and True North plotted on the photo. True and chart North were then compared and Chart North found to be 3° 50' west of True.

LOCATION MAP



2.4 Photo mosaics were made for each sheet, and bromide copies and half tone film positives (from which paper dyeline copies could be made) were supplied to SSD for office editing, i.e. addition of names and other cultural information. That information was provided on overlays to the mosaics, which were returned to DOS for graphics and printing. The maps, designated Series DOS304P (1:25 000), DOS204P (1:10 000) and DOS104P (1:5000), were published in 1978-79.

3. DOPPLER SURVEY

3.1 In 1981 the Overseas Development Administration of the British Government agreed to assist the Seychelles Government with the determination of its EEZ. That required the fixation of the eight islands in the south west of the Republic that had not previously been surveyed by DOS or the Royal Engineers. Aldabra was included in the scheme to bring it onto WGS72 Datum. The fieldwork was carried out using the JMR-1 satellite doppler receivers of DOS, operated by a DOS surveyor and assisted by SSD staff.

3.2 The field team was carried around the islands on a yacht chartered by the SSD. The team went ashore for three days on each island, in which time the following work had to be completed: reconnaissance, station marking and documentation, Doppler operation and data checking and azimuth observation. Site selection, to meet the criteria for Doppler operation (i.e. clear horizon above 15°, absence of reflective surfaces and electrical sources) was often difficult. In addition there had to be points of identifiable detail reasonably close to the Doppler station - not easy to find on 21 year old photography - and a clear line of sight of at least 250 m in which to site an azimuth mark. 25-30 satellite passes were required for an adequate position fix.

3.3 The task was completed in six weeks during June and July 1981. Logistical difficulties dictated a short observation period, and weaker fix, on Cerf Island. The absence of a safe place of access to St Pierre Island prevented the landing of all the party's equipment and material: Doppler observations were made but the photo points were oriented on magnetic north and an azimuth mark was not sited.

3.4 Computation was carried out using DOS in-house software and the Broadcast Ephemeris. The minimum number of computable satellite passes remaining after the various data filtering stages was 17, at Station DP6 (Cerf). The maximum number was 30, at Stations DP1, DP3 and DP5 (Aldabra, Astové and Farquhar). The spreads in X, Y and Z at any station over the last eight passes were less than 3.5 m; at seven of the eight stations the spreads were less than 2.0 m.

4. GRIDDING

4.1 In February 1992 the SSD requested that eight of the photomaps be recast on WGS72 Datum, UTM grid, using the Doppler photo control that had been observed in 1981. The map sheets concerned were Aldabra East, Aldabra West, Assomption,

Astové, Cosmoledo Group, Providence Group (North) and St Pierre, Providence Group (South) and Farquhar Group. The job was to be on repayment terms. Assomption and Astove were 1:10 000 and the others 1:25 000. The 1:10 000 sheets of the Cosmoledo and Farquhar Groups were not recast.

4.2 The Doppler station photopoints were identified on the photomaps and a comparison made between the Doppler and map geographical co-ordinates. The differences were considerable:

<u>Island</u>	<u>Approx shift</u>	<u>Photomap (i.e. Astro Datum)</u> <u>to WGS72 Datum</u>
Assomption	410 m	SE
Astové	2020 m	SE
Cosmoledo	1430 m	SSE
Providence	920 m	NW
Cerf	960 m	WNW
Farquhar	1140 m	SW
Aldabra	550 m	SE
St Pierre	2010 m	SE

4.3 The Doppler photopoint co-ordinates were plotted on 1:25 000 and 1:10 000 grids, which were laid over the photomaps and fitted to the previously identified map positions of the photopoints. In each case, apart from Providence Group, the grid and map positions of the two or three photopoints co-incided, confirming the scale deduced from air photographs and Hydrographic Charts in 1977. However, the closeness of the photopoints - typically 100 m - to each other and to the single Doppler station on each island meant that the maps could not be described as fully controlled. The scale statements "1:25 000 (Approximate)" and "1:10 000 (Approximate)" were, therefore, retained.

4.4 UTM grid co-ordinates were computed for the 1' intersections near each map corner, so that WGS72 graticule ticks could be plotted on the neatline: the graticule values of the actual sheet corners remain indeterminate. Also computed was the grid convergence value for the centre of each sheet, to be used in the Magnetic Data diagram in the footnotes. Orientational errors in the Edition 1 photomaps were immediately apparent when the new graticule ticks had been plotted on the neatline. It was accepted that the azimuths taken from small scale hydrographic charts in 1977 would be approximate; the large error, 12° 30' west of True, in the St Pierre inset of Providence Group (North) sheet can be explained by the very rounded shape of the island - the azimuth on Edition 1 was derived from the map by B.H.Baker in *Geology and Mineral Resources of the Seychelles Archipelago* (1963) and was not checked against air photography. An extract of the Providence Group (North) sheet is attached to this paper.

4.5 On the two Providence Group sheets there was poor fit between the grid and map positions of the photopoints. The identifications and co-ordinates were checked and found to be correct and a "best fit" of grid to map was tried. When the sheets, North and South, were joined there was an obvious discontinuity in the grid. The grids on each sheet were, however, parallel, indicating an error in scale (but not azimuth) in the photomaps. The distance between a photopoint on Providence Island (North sheet) and on Cerf Island (South sheet) was measured and compared with the computed distance at map scale. There was a difference of

9.6 mm in 1314 mm, indicating a photomap scale of 1:25 184. The map components were enlarged photographically by a factor of 100.731 % to achieve the correct map scale of 1:25 000. When fitted to the re-scaled maps, the grid ran perfectly across the join between the two sheets.

4.6 The maps were printed at Ordnance Survey in February 1993 and are available from the Surveys and Lands Branch, Ministry of Community Development, P.O.Box 199, Victoria, Republic of Seychelles and from OS International, Romsey Road, Southampton SO9 4DH, U.K.

5. CONCLUSION

This project is an illustration of the value of retaining original survey data, photography and map reproduction material beyond a date when it might appear obsolete. Data that had been collected up to thirty years ago was used in producing, by a judicious mixture of technical skill and ingenuity, an end product that will be invaluable to the Seychelles Government for EEZ definition purposes. Had OS International not retained the data, a costly re-survey would have been necessary.