



# XXVII FIG CONGRESS

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## MVCORS – the first permanent GNSS network of Maldives (11525)

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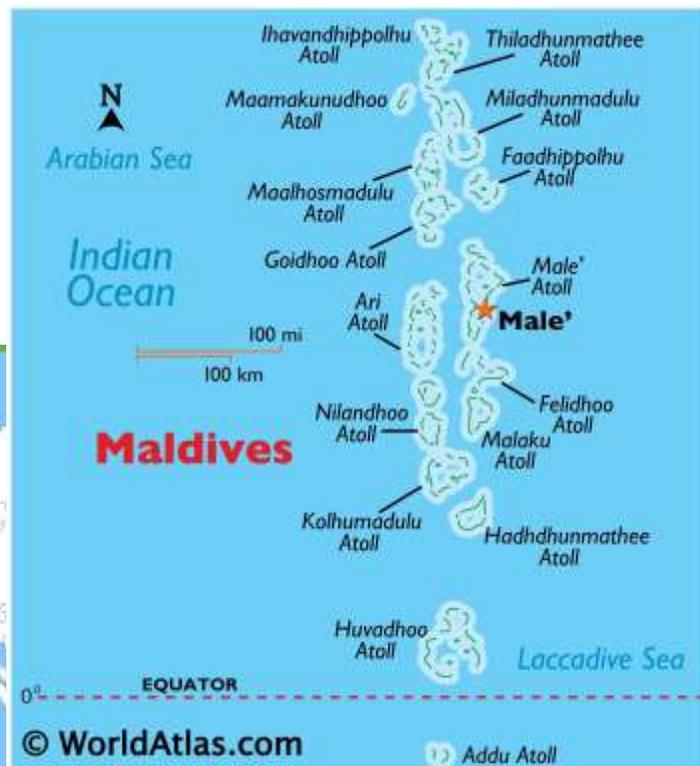
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## Introduction



- The Republic of Maldives lies in two rows of atolls in the Indian Ocean that stretches for approximately 820km from 7 degrees north to 1 degree south, with the greatest width from west to east being 130km.
- The territory embraces a total area of 90,000 sq km but that includes the sea, which forms 99.6% of the Maldives.
- The land area of all the islands amounts to 298 sq km.



## Introduction



- No national-wide datum has been established in the country until the present.
- The only geodetic datum considered for use over the entire territory of Maldives was Gan 1970, referenced to the International 1924 ellipsoid and the Greenwich prime meridian.
- However, it is very inaccurate: the transformation published by NIMA (1997) in relation to WGS84 (three translations only) have errors of  $\pm 25\text{m}$ .

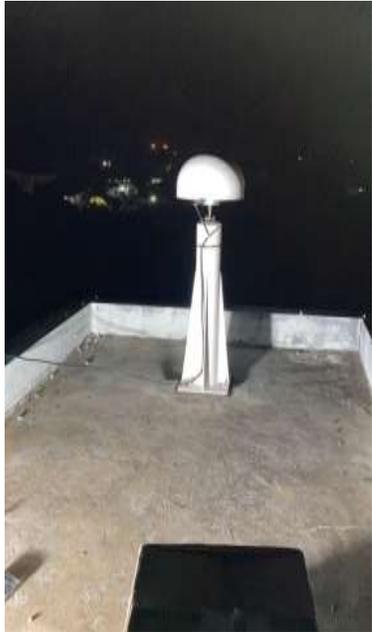


## MVCORS – Maldivian CORS Network



- MVCORS is a project promoted and funded by Foresight Surveyors.
- To provide accurate reference points for dissemination of RTK corrections in the most economic active atolls and to permit the densification of control episodic points using the CORS as reference at more distant locations.
- It is foreseen a total number of 21 stations covering the entire territory of Maldives.
- Currently, Phase I (8 stations) has been finalized.

## MVCORS – Hardware



Addu (ADDH)



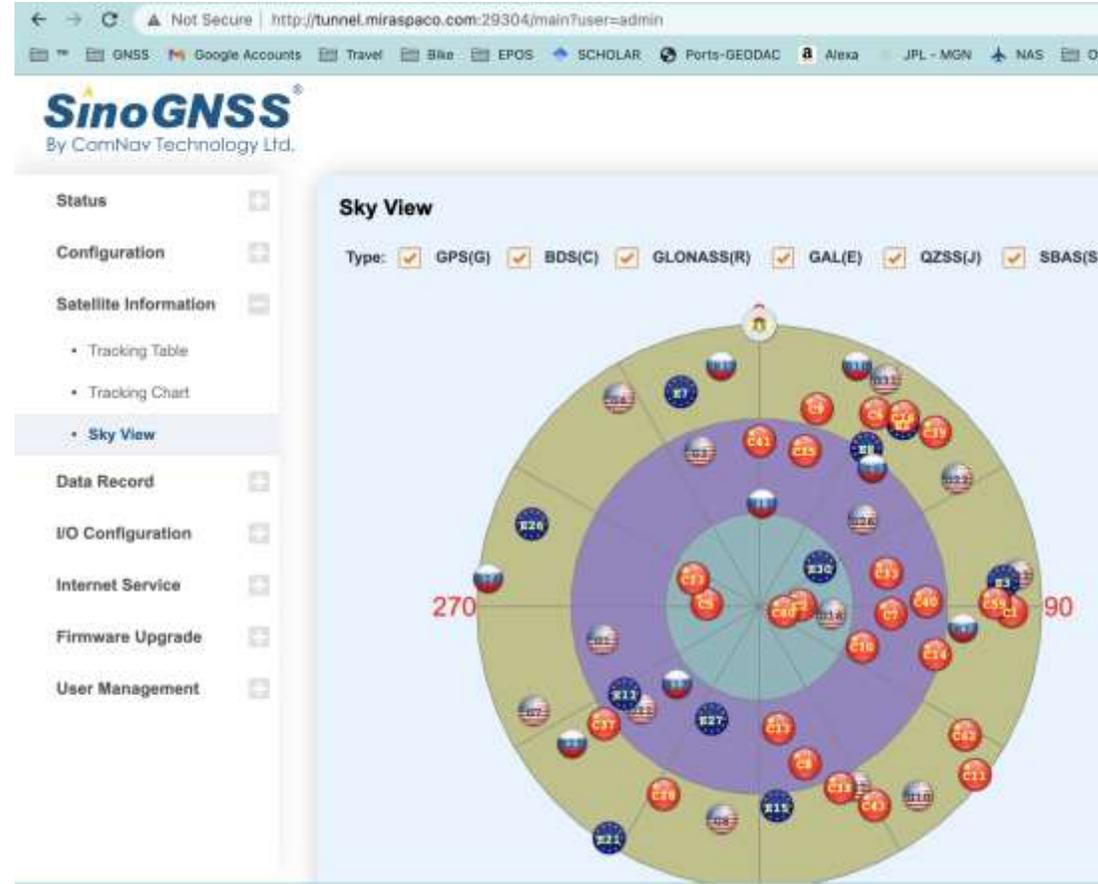
Kudarikilu (KDRK)



Malé (MALC)

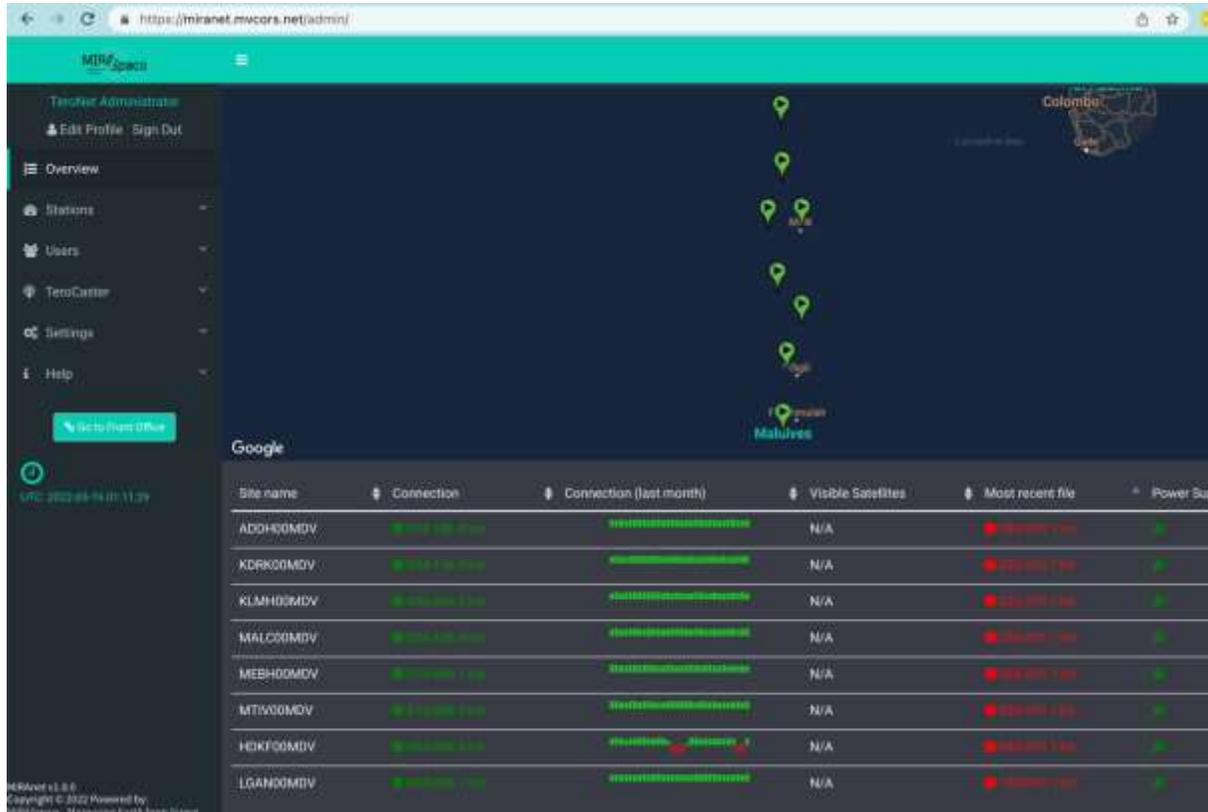
- The GNSS equipment is provided by ComNav, a partner of Foresight Surveyors.
- The antennas (CNTAT600) are of choke-ring type having official calibration at the latest IGS (International GNSS Service) antex file.
- The antennas are mounted using self-centering mount devices that guarantee that the antennas are horizontal and properly oriented to North.

## MVCORS – Communications



- MIRASpaco, a spin-off of University of Beira Interior, Portugal, has provided an integrated solution that, making using of routers with proprietary firmware, permits the remote access to the stations without the need of a public static IP thus significantly lowering the costs.

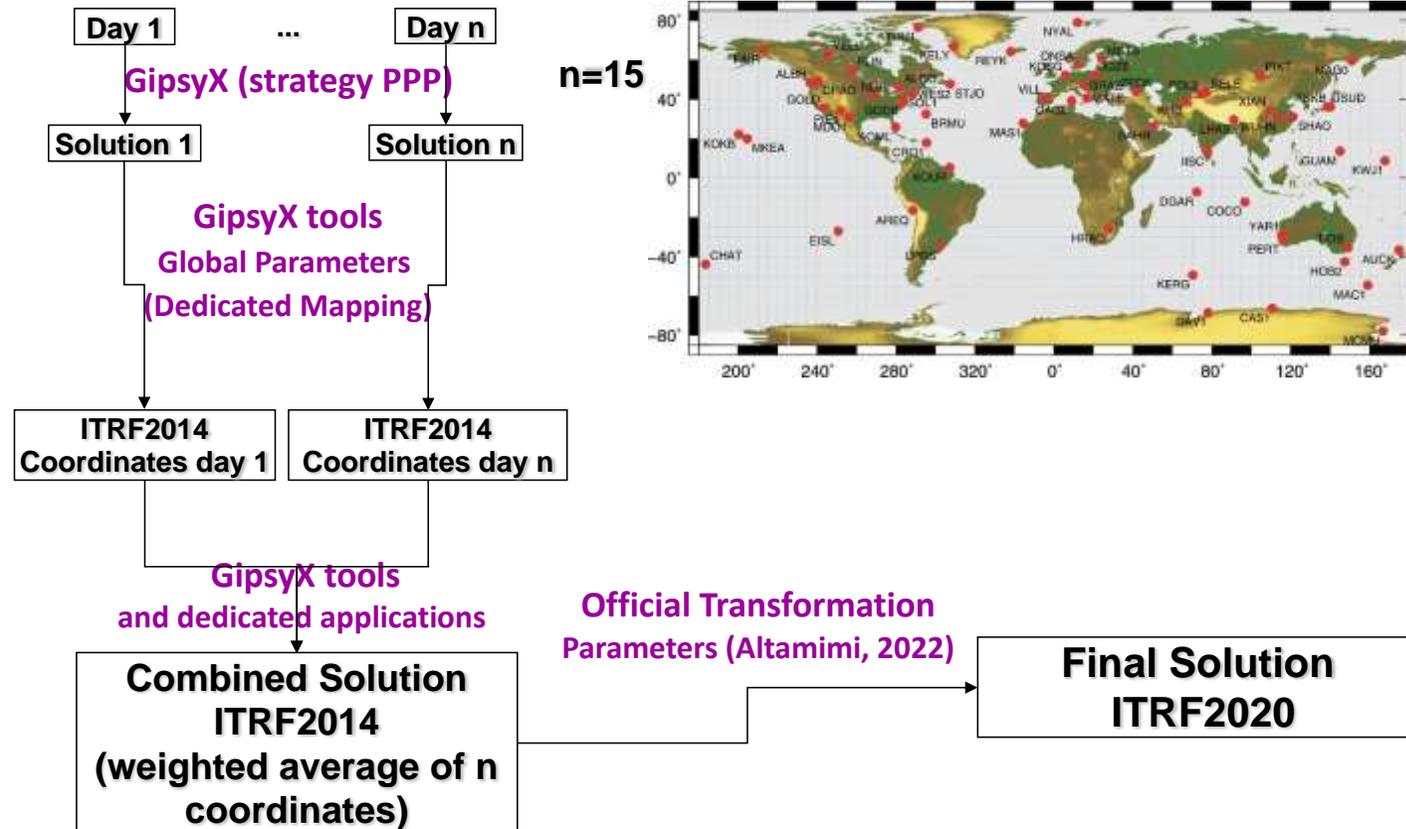
## MVCORS – Software



| Site name | Connection | Connection (last month) | Visible Satellites | Most recent file | Power Sup |
|-----------|------------|-------------------------|--------------------|------------------|-----------|
| ADDH00MDV | OK         | OK                      | N/A                | OK               | OK        |
| KDRK00MDV | OK         | OK                      | N/A                | OK               | OK        |
| KLMH00MDV | OK         | OK                      | N/A                | OK               | OK        |
| MALC00MDV | OK         | OK                      | N/A                | OK               | OK        |
| MEBH00MDV | OK         | OK                      | N/A                | OK               | OK        |
| MTIV00MDV | OK         | OK                      | N/A                | OK               | OK        |
| HDKF00MDV | OK         | OK                      | N/A                | OK               | OK        |
| LGAN00MDV | OK         | OK                      | N/A                | OK               | OK        |

- MIRASpaco also made available *MIRAnet*, which is a management software for CORS networks:
  - Realtime CORS GNSS networks monitoring;
  - Easy and controlled access to station's data;
  - Simple network management;
  - Integrated system independent of GNSS receiver brand/model.
- MIRAnet also incorporates a caster allowing the access also to the RTK solutions for all MVCORS stations

## MVCORS – Estimation of Station Coordinates - Methodology



- The positions of the MVCORS have been computed with respect to the latest International Terrestrial Reference Frame, ITRF2020, at the Reference Epoch: 19<sup>th</sup> April 2022.
- First, daily solutions were computed using GipsyX (JPL) for 2 weeks.
- The positions were first computed with respect to ITRF2014 because there were still not products (orbits and clocks) in ITRF2020 that permit the direct computation in this global reference frame.
- The averaged coordinates were finally computed with respect to ITRF2020 by applying the official transformation parameters between ITRF2014 and ITRF2020.

## MVCORS – Estimation of Station Coordinates - Statistics

| SITE | E (mm) | N (mm) | U (mm) | # Days |
|------|--------|--------|--------|--------|
| ADDH | 1.9    | 1.6    | 6.1    | 15     |
| HDKF | 1.8    | 1.6    | 4.3    | 15     |
| KDRK | 1.9    | 0.9    | 5.2    | 14     |
| KLMH | 1.9    | 1.2    | 5.1    | 15     |
| LGAN | 2.0    | 1.5    | 4.0    | 13     |
| MALC | 1.9    | 1.6    | 6.0    | 12     |
| MEBH | 1.3    | 1.4    | 5.7    | 15     |
| MTIV | 1.4    | 1.4    | 3.8    | 14     |

- The weighted r.m.s. of the residuals for the combined solution using a period of 15 days (April 2022, 13-28) shows very good repeatabilities with 1-2 millimetres in the horizontal components and few millimetres in the vertical component.
- These results show the MVCORS stations are stable and capable of providing a very robust materialization of a new geocentric reference frame for the Republic of Maldives.

## Conclusions



- MVCORS, the first CORS network of Maldives, is capable to permanently realize a new and modern reference frame for the entire Republic of Maldives.
- The eight installed CORS stations installed in the Phase I are already serving the georeferencing activities in Maldives providing a very accurate and uniform datum that can be accessible by any user at <https://miranet.mvcors.net>.

