# Human Factor as an Important Phenomenon of Global SLR Network

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For more than one decade, the necessity of balanced distribution of SLR stations through the whole world was emphasised. As an example, we can quote from Proceedings of Belmont SLR Workshop 1994 (Summary, p. 12):

- Long-term goals: *A global network of well-distributed SLR stations will be needed to support terrestrial reference frame, gravity field and geoid studies, precise orbit determination, technique intercomparisons, and special science missions.*
- Programmatic and technical goals: *b. Improve the geographic distribution of stations.*

## Present situation

The global distribution of SLR station still does not suit these goals, see Husson (1999).

One of the main reasons is that almost all efforts of SLR scientific community has been directed towards the technological improvement of SLR stations although proclamation of the Commission of the European Communities stresses the human factor:

- Human Capital and Mobility 1991 - 1994 (Commission of the European Communities Project): *Activity 2: Scientific and technical cooperation networks: The development of research networks linking several teams or laboratories with complementary capacity … These networks as a whole must together extend across all the regions of the Community countries, with particular reference to the special needs of the peripheral areas and the currently less-favoured regions. This will facilitate the establishment of a highly qualified scientific and technological potential in those regions and will also facilitate the integration of this potential in the overall scientific environment of the Community. In addition, encouragement will be given to the setting up of new research teams in such regions, these new teams being centered on young researchers trained abroad.*

Replacing in this text "Community countries" by "Satellite Laser Ranging Stations" and "regions" by "world" gives one of the possible solutions for better geographic distribution of SLR stations.

## Helwan SLR station

In Africa since 1974, the only working SLR station has been in Helwan, Egypt.

### 1. Generally:

The governmental and institutional support will be given providing that the SLR technology will be accompanied by:

- Improving qualification of local researchers
- Joint operation of SLR station
- Training the staff (locally as well as abroad)
- Motivation of staff
- Involving local researchers in ILRS projects

### 2. Current situation:

- From 1997: intensive training of local staff both, in Helwan and in Prague
- From August 1998: SLR Helwan is operated by the local staff only with the intensive communications with Prague group

The summary of results can be found e.g. in
http:/www.dgfi.badw-muenchen.de/edc/edc.htm
http://www.dgfi.badw-muenchen.de/edc/ilrs/
http://ilrs.gsfc.nasa.gov

### 3. Costs of operation of SLR station and investments (per year)

- **Czech Republic**
  - *Czech Technical University in Prague*: salaries incl. taxes (5 scientists, 20 % of the year salary per person)
    7 000 USD
  - *Grant Agency of the Czech Republic* (scientific upgrading, small equipment, spare parts, travel, communication …)
    11 000 USD
  - *Grant Agency of the Ministry of Education of the Czech Republic* – ESA projects (ERS tracking, investment to the human capital and mobility, equipment)
    16 000 USD

- **Egypt**
  - National Research Institute of Astronomy & Geophysics
    - investments to equipment
      10 000 – 20 000 USD
    - staff salary
    - human mobility
    - SLR operating costs (service, energy, …)

## 4. Main goals:

- All-year SLR station operation
- Mostly operated by Egyptian staff
- Reducing the costs of field operations

## Conclusions

The above given survey of one individual SLR station illustrates one way of improving the geographical distribution of SLR stations in the less-covered areas without enormous costs. The stress should be given on the involving local staff in the daily operation of the station.

## References

Satellite Laser Ranging in the 1990s - *Report of the 1994 Belmont Workshop*. Proceedings of Belmont SLR Workshop, GSFC, Laboratory for Terrestrial Physics 1994. Ed. J. Degnan.
Synopsis http://cddisa.qsfc.nasa.qoc/slr_brochure/belmont_rpt.html

Husson, V.S. (1999). SLR Global Performance Evaluation. In: Proceedings 11th International Workshop on Laser Ranging. Deggendorf, September 21-25,1998.

This paper has been conducted as a part of the projects;

- *Satellite Laser Ranging Altimeter for ERS-2 in SLR Station Helwan, Egypt 1997 - 2000*, Ministry of Education, Czech Republic, No: ME093.
- *Satellite Laser Ranging Station Helwan as a Part of the Global Network*, Grant Agency of the Czech Republic, No. 205/97/0130