



Republika Hrvatska
Državna geodetska uprava



Marinko Bosiljevac, dipl.ing. , Prof.dr.sc. Željko
Bačić, dr.sc. Marijan Marjanović

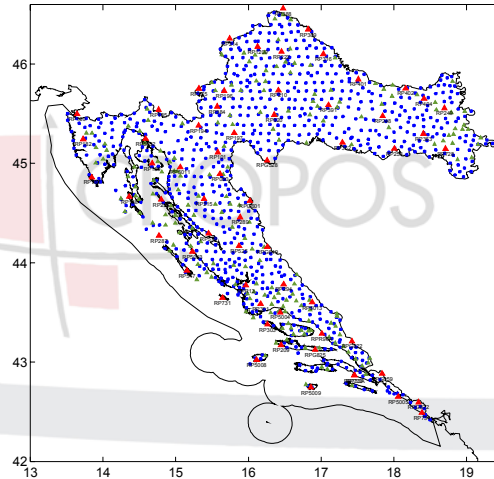
FIG Working Week,
3-8 may, 2009 Eilat, Israel

Content of presentation

- **Introducing – Croatian terrestrial referent system - HTRS96**
- **CROPOS - CROatian POsition System – realisation**
- **CROPOS – technical characteristics**
- **CROPOS – terms of using the service**
- **Conclusion**

Croatian terrestrial referent system – HTRS96

Croatian Basic Network	POINTS
I. Order Network	78
II. Order Network 10X10 km	1023



Croatian terrestrial referent system – HTRS96

- I. Order Basic Network – CROREF 1994/95/96 GPS Campaigns - 78 points
- II. Order GPS Network – 1997 - 2002 - 1023 points
- 2004. - The Government of the Republic of Croatia on proposal of the Geodetic State Administration brought a Decision of the establish a new official geodetic datums and map projections of the Republic of Croatia
- 2005. - SGA brought Program of implementation of new referent system
- Establishment of GNSS permanent network - CROPOS – the most important tool for its implementation

Why CROPOS?

- Compared to the present application of the GNSS survey methods, use of CROPOS have the following advantages
 - reduction of investment in the required equipment (for approx. 50%)
 - reduction in time (at least 50) and human resources (at least 50%) – during the surveying
 - while at the same time increasing the accuracy, reliability and homogeneity of the obtained surveying results
 - service available 24/7/365

CROPOS – project realisation

- 2004. – feasibility study – bilateral cooperation with German GTZ
- 2005. – project adopted for financing through National PHARE 2005 Programm
- 2006. – finalized network design and tender documentation
- 2007. – international supply tender was conducted and contract was signed with Trimble Europe
- 2008. – delivery and installation for all GNSS measure and ITC equipment was done
- 09.12.2008. service CROPOS was run in official and practical use

CROPOS – technical characteristics



- 30 permanent stations
- 1 control centre – SGA Zagreb
- Distance between stations app. 70 km
- PS located on the buildings of our cadastral offices

CROPOS – Permanent Stations



- Trimble Zephyr Geodetic - GNSS antennae
- Trimble NetR5 GNSS receiver



CROPOS – Control centre

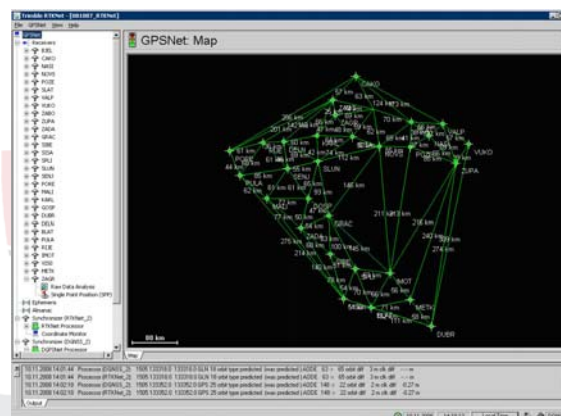


- ITC equipment
 - Helwet
 - Pachard
 - Cisco
- Trimble GPS Net Software



Control of System Functioning

- Department of the Basic Fundamental Works are responsible for running, monitoring and maintenance of system
- Trimble GPS RTK software is used for continuous monitoring of PS



Independent Control System

- 2 control PS
 - stimulating users in the field
 - Approx. 600 initialisation per day
- RTK Mon
- Java Servlet
- www.cropos.hr



Calculation of PS Coordinates a

- Bernese GPS software ver. 5.0
- 7 x 24 sata
- ITRF2005, 2008.83 (1503)
 - 30 GNSS stations
 - 4 referent IGS points
 - 8 control IGS points
 - $\sigma = 1.5$ mm, $\sigma_\varphi = 1$ mm, $\sigma_\lambda = 1$ mm, $\sigma_h = 3$ mm
- ETRF00 (R05) (~ETRF89)

CONTROL IGS POINTS (EUREF – CROPOS)

Point	State	DX (m)	DY (m)	DZ (m)
MEDI	Italy	-0.002	0.008	-0.001
POTS	Germany	0.002	-0.002	-0.002
PENC	Hungary	-0.004	-0.007	-0.004
KOSG	Netherland	0.005	-0.001	0.001
GOPE	Czech Republic	-0.001	-0.003	-0.005
JOZE	Polland	-0.002	-0.004	-0.004
BRUS	Belgium	0.002	-0.001	-0.001
OSJE	Croatia	-0.003	-0.004	-0.003

CROPOS - System testing

- Measuring 372 points of basic referential network evenly dispersed over the country
 - Accuracy of the coordinates determination
 - System availability
- Two independent session in period not less than 2 hours - 3x5 sec, 3x30sec, 3x60sec
- Achived accuracy for determining the position is about 1 cm and 2 cm for altitude

CROPOS services

CROPOS services	METHOD SOLUTIONS	DATA TRANSFER	ACCURACY	DATA FORMAT
DSP	network solution of coded surveys in real time	Wireless Internet (GPRS, UMTS) NTRIP protocol GSM	±0.3 do ±0.5 m	RTCM 2.3
VPPS	network solution of phase surveys in real time	Wireless Internet (GPRS, UMTS) NTRIP protocol GSM	±2 cm (2D) ±4 cm (3D)	RTCM 2.3 RTCM 3.1
GPPS	<i>post-processing</i>	Internet (FTP, e-mail)	±1 cm (2D, 3D)	RINEX RINEX VRS

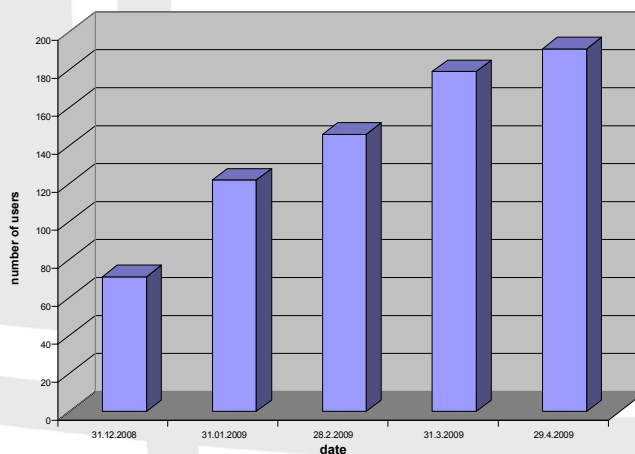
CROPOS - terms of using services

- CROPOS services are available only for registered users
 - Application form
 - Personal details
 - Type of services and number of licenses
 - Accept terms of using the services
- User name and password for accessing specifics service

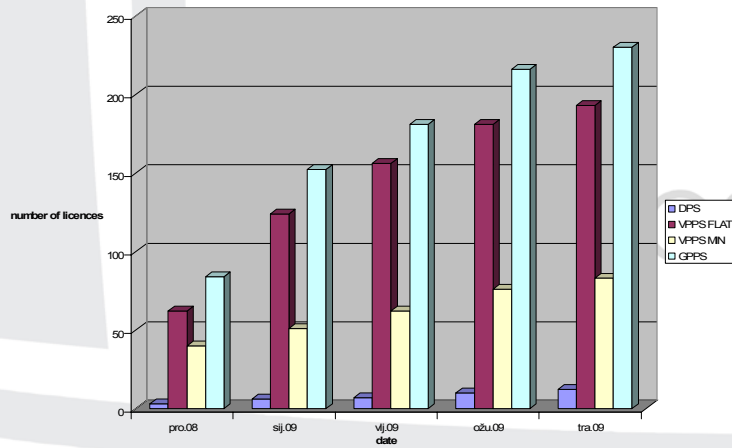
CROPOS - Pricelist

Type of service	Accuracy	Data Format	Unit	Price	Registration Costs
CROPOS - DPS Differential positioning service	0.3 - 0.5 m	RTCM 2.3	1 year*	HRK 1,000	
CROPOS - VPPS High-precision positioning service	0.02 - 0.04 m	RTCM 2.3 RTCM 3.1	1 minute 1 year	HRK 0,35 HRK 5,000	HRK 300*** (1€ = 7,4 HRK)
CROPOS - GPPS Geodetic precision positioning service	<i>post-processing</i>	RINEX RINEX VRS	1 minute**	HRK 0,50	

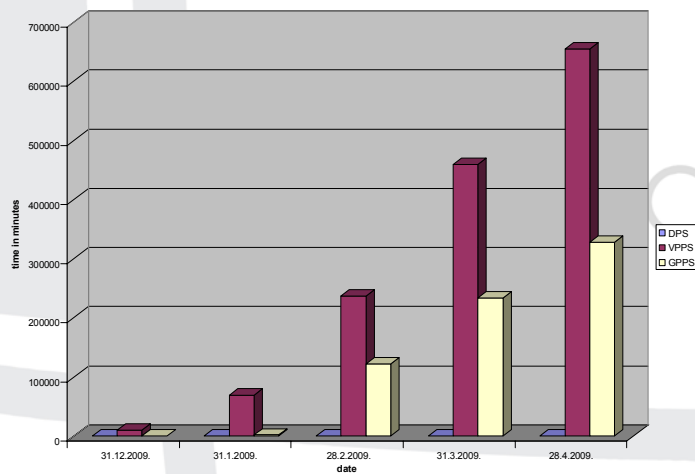
CROPOS - users



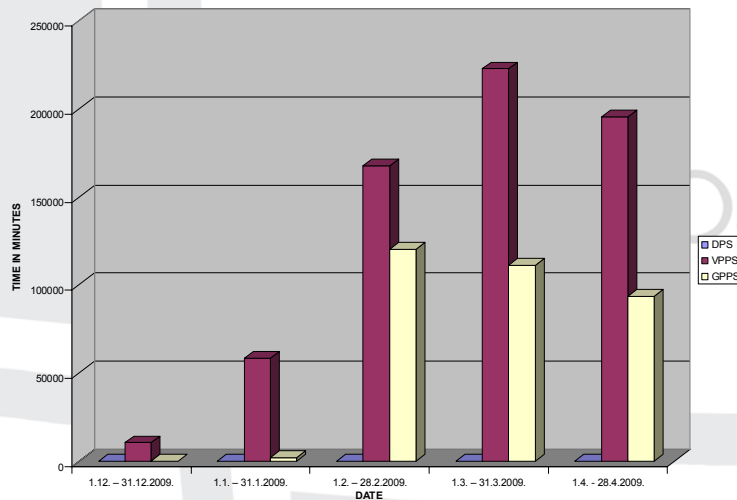
CROPOS – users



CROPOS – system use



CROPOS – system using



Conclusion

- CROPOS is fully functional
- Only after 4 months of usage fully integrated in Croatian surveying society
- Pricing model combines cost recovery (achieved) and fostering economy
- Future effort focused on non surveying users (DGPS service) and improvement (simplification) of transformation issue
- Networking with neighbouring countries

Thank you for attention!

