

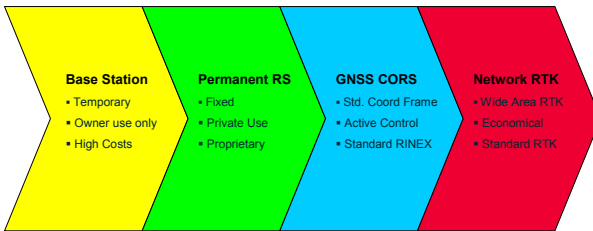
FIG 2007
Overview of Various GNSS Networks

Neal Toso
Product Marketing Director
Leica Geosystems Inc.

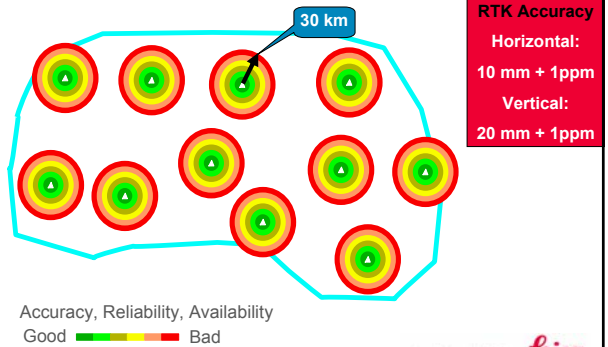
Agenda

- Evolution of Reference Stations
- Motivation for Reference Station Networks
- Anatomy of a Reference Station Network
- Importance of Standards
- Reference Networks World Wide
- CORS Stations in Latin America
- Sample of Reference Networks in the USA

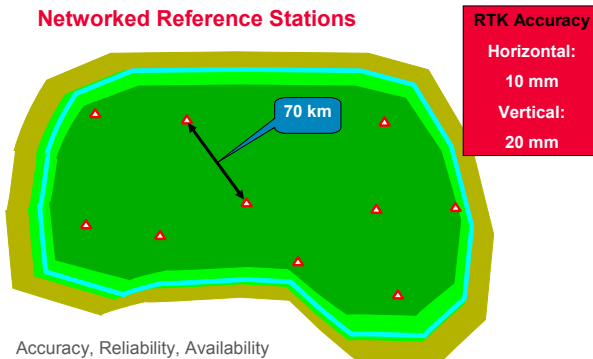
Reference Station Evolution



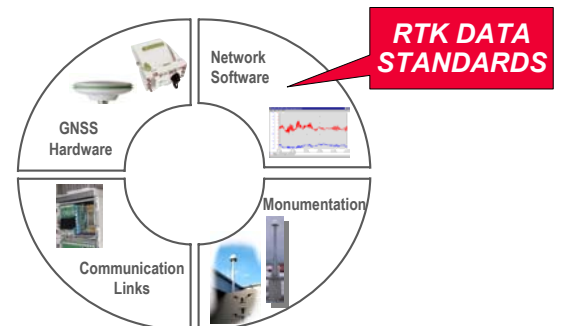
Single Baseline RTK Reference Stations



Networked Reference Stations



Anatomy of a Reference Station Network



Importance of RTK Network Standards

ROVER COMPATIBILITY

RTCM V3.X Corrections for Network RTK

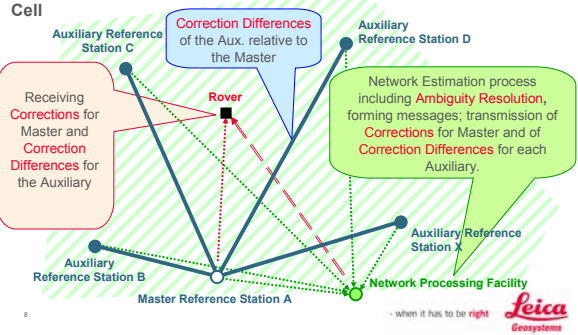
7

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RTCM 3.x Master Auxiliary Concept (MAC)

One Master Reference Station, plus

Several Auxiliary Reference Stations Equals One Network



8

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RTK Network Data Compatibility

SpiderNET affords MAC solutions ...

Broadcast MAC requires One-way Communications

1) Undifferenced GPS observations (from all RS in Network)



2) MAC Information (for all RS in Network)

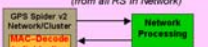
3) RTCM V3 Corrections and MAC for nearest RS

Leica - MAX

and also 'Individualised' solutions

'Individualised Corrections using MAC' (i-MAX) requires Two-way Comms

1) Undifferenced GPS observations (from all RS in Network)



2) MAC Information (for all RS in Network)

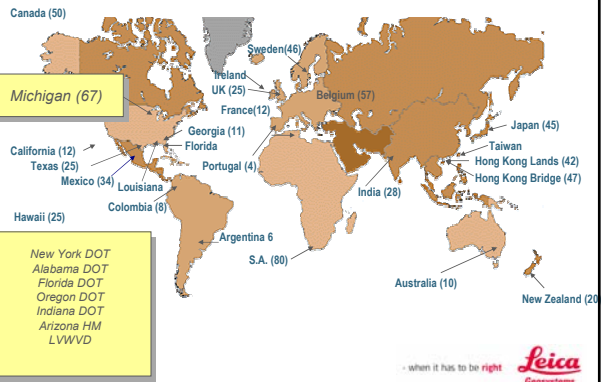
3) 'Individualised MAC-corrected' data from nearest RS: - RTCM V3 - RTCM V2.3

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9

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GPS Reference Stations and Network Installations Leica Networks



10

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CORS and Network Stations in Latin America

Where	Who	Sites	Where	Who	Sites
Argentina	Universidad Nacional de Cuyo, Facultad de Ingenieria, Instituto CEDIAC	4	Brasil	Mantra/Cesumar	1
Brasil	CJW/CEFETS	1	Brasil	Mantra/EAFA	1
Brasil	CJW/Copersucar	1	Brasil	Mantra/Tecon	1
Brasil	CJW/Copiana	1	Brasil	Mantra/ULBRA	1
Brasil	CJW/EESC	1	Brasil	Mantra/Unicomp	1
Brasil	CJW/Geraldo Lins	1	Brasil	Mantra/Unianos	1
Brasil	CJW/São Carlos	1			
Brasil	CJW/UNIVAP	1	Brasil	Universidade De Sao Paulo, Escola Politecnica, Depto. De Eng. De Transportes	1
Brasil	FAPEG	1	Brasil	Universidade Estadual Paulista (UNESP) - Presidente Prudente	2
Brasil	Geomat	1	Brasil	Usina Hidreletrica de Itaipu, Divisa de Engenharia Civil e Arquitetura	1
			Brasil	Mantra/Sanepar	1

11

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CORS and Network Stations in Latin America

Where	Who	Sites	Where	Who	Sites
Chile	Sociedad Minera El Abra	1	Mexico	Junta de Agua Potable y Alcantarillado de Tuxtla (JAPATV), Dept. Sistemas de Informacion Geografica	1
Colombia	IGAC Instituto Geografico Agustín Codazzi	11	Mexico	Universidad Nacional Autonoma de Mexico - Instituto de Geofisica, Servicio Sismológico Nacional	27
Colombia	Acuoducto de Bogota	1	Mexico	Universidad Nacional Autonoma de Mexico - Instituto de Ingenieria - Coordinación de Estructuras y Materiales	3
Costa Rica	Instituto de Investigación: Observatorio Vulcanológico y Sismológico de Costa Rica. (OVSISICOR) Universidad Nacional (UNA)	4	Mexico	Municipio de Querétaro, Dirección Municipal de Catastro	1
Costa Rica	Instituto de Investigación: Observatorio Vulcanológico y Sismológico de Costa Rica. (OVSISICOR) Universidad Nacional (UNA)	4	Peru	PRODAPP	1
Mexico	Centro de Investigación Científica y de Educación Superior de enseñanza CICESE, División Ciencias de la Tierra, Departamento de Sismología	3	Peru	Química Suiza	1
Mexico	Comisio Federal de Electricidad, Complejo Hidroelectrico El Cajon	1	Peru	Universidad de Pura	1
Mexico	Comision Nacional del Agua, Subgerencia de Informacion del Agua	7	Uruguay	Instituto Geografico Militar	2

12

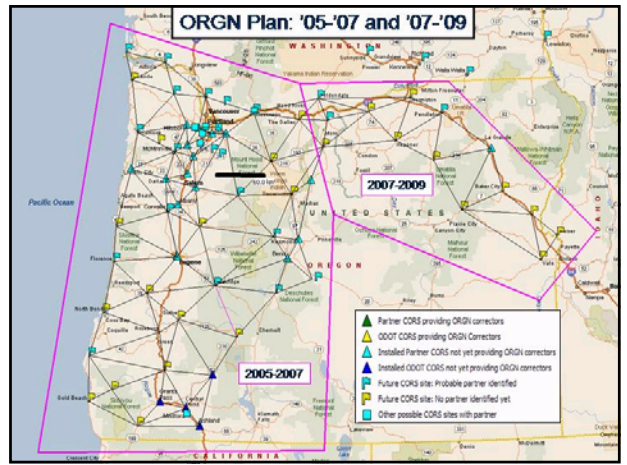
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Owner Operators GPS Networks

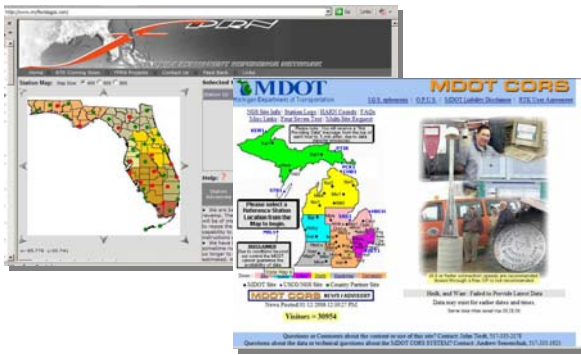
SpiderNet Installations

Network	State	Entity	Dev. Status	# of Stations	User Fee/Rover	# User Accounts
Pierce County CORS Network	PC/N	WA	public	mature	7 (cores) / 6 (net)	none / 41
Puget Sound Regional GPS	PSGRS	WA	private	building	15	\$100/mo / 36
Hasslerbach Surveying	RTK MAX	CA	private	mature	12	\$1500/yr / 50+
Oregon DOT Network	OR/N	OR	public	evaluation	9	none/3a
Las Vegas Valley Water District	LVVWD	NV	public	building	5	none / internal only
Mason County Public Works Network	MCPW	OR	public	mature	3	none / internal only
New York DOT Network	NYDN	NY	public	building	36	none / internal only
Florida DOT Network	FLDN	FL	public	building	40	none / internal only
Michigan DOT Network	MDOT CORS	MI	public	building	70+ (core) / 41 (net)	none / 96+
Georgia Reference Network	GRN	GA	private	mature	11	\$300-\$125/mo
Earl Dudley Associates Network	EDNet	AL, TN, GA	private	mature	20+	\$300-\$125/mo
Easy Drive Network	E-Net	TX	private	mature	18	yes / 250/mo
Loyola Spatial Systems	RTKNet	TX	private	building	18	yes / 95+
Collier County	CC	FL	public	building	7	none / 30+

*This list is not exhaustive and does not include agencies/businesses operating reference stations offering baseline solutions only.



Statewide

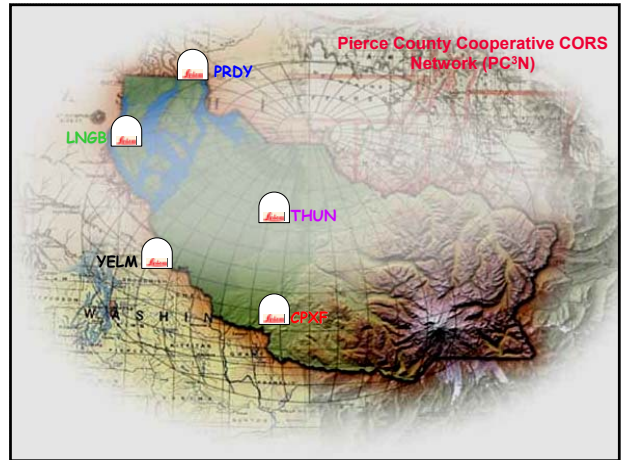


<http://www.myfloridagps.com/>

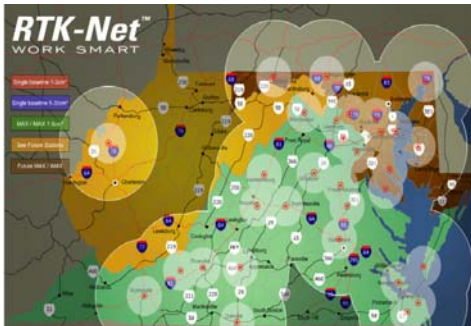
<http://www.mdotcors.org/>



Pierce County Cooperative CORS Network (PC'N)

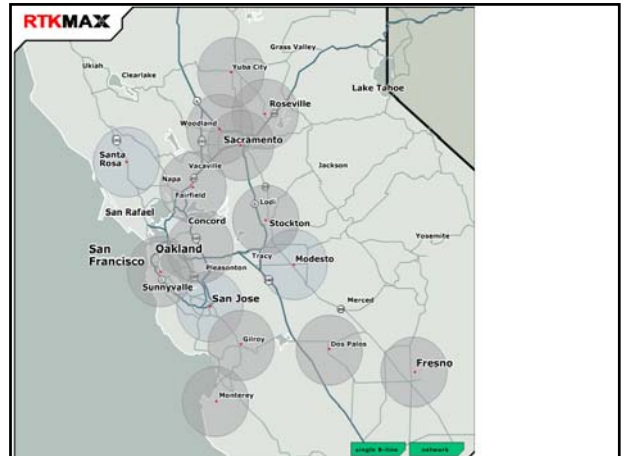


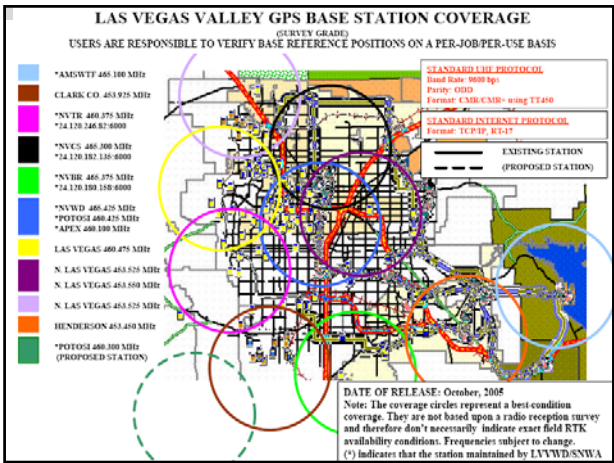
Loyola Spatial Systems



17

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Questions?

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