Generalitat de Catalunya
Institut Cartogràfic de Catalunya

To whom it may concern,

In this project, the ICC has studied the calculations made by Leica Geosystems and the Spanish "Instituto Geográfico Nacional" (IGN-E). The IGN-E calculations have been made with Trimble Geomatics Office (TGO) software. First of all, reading both reports, they seem good ones. The basic difference of the results is in the coordinates that they have employed (they both have fixed some coordinates different of LHAS station). Then the ICC has put all the data in a common reference frame to check both solutions. We explain, now, the proceeding used:

1) GPS baselines have been computed (differences of cartesian coordinates) from both solution reports. The error, between both solutions, is 2-3m. If we suppose that both solutions can be good, we can take as the final solution the average of them.

2) The coordinates of LHAS, according to the IGS network are referred to ITRF2000 (epoch 1997.0), where the position and the velocity are both known. If we take into account that the measures were carried out on July, 14th (2005.53) and on July, 27th (2005.57), the correct one is to take the coordinates of LHAS referred to ITRF2000 epoch 2005.55.

3) The coordinates of KARD and SEMO are computed applying LHAS coordinates to each averaged baseline and are referred to ITRF2000 (epoch 2005.55). Then the associated ellipsoidal heights are: 5335.9 ± 1.8 m in KARD, 5536.0 ± 1.1 m in SEMO (for the standard deviation, the baseline error has been propagated and transform to geodetic coordinates) .

4) Then to obtain the orthometric heights (the final ones) is necessary to know the geoid undulations of each point. In this study the EGM96 geoid model (-23.4m for KARD and -29.1m for SEMO, respectively) has been used. So, the final heights are: 5359.3m for KARD and 5565.1m for SEMO.

Best regards,

Assumpció Térmens
Head of Geodetic Research
Geodesy Department

Barcelona, March 20, 2006

Pedals al Cel / ICC@2005

	ITRF	Epoch	XX	YY	ZZ	VX	VY	VZ	Year	DOY
IGS	2000	1997.00 LHAS	-106937.6690	5549269.5910	3139215.7620	-0.0462	-0.0076	0.0121		ITRF2000_GPS.SSC
LHAS			0.0010	0.0030	0.0020	0.0005	0.0011	0.0007		
	2000	2005.53	-106938.0633	5549269.5261	3139215.8653				2005	195	14/07/05 Semo
	2000	2005.57	-106938.0649	5549269.5259	3139215.8657				2005	208	27/07/05 Kardung La
LHAS	**2000**	**2005.55**	**-106938.0641**	**5549269.5260**	**3139215.8655**					

LEICA (SKIPro)

IGN-E (TGO)

		XX	YY	ZZ	VX	VY	VZ		
	LHAS	-106942.1680	5549274.7463	3139222.2667	-4.1039	5.2203	6.4012		9.22
	KARD	1133431.1412	5157221.1886	3575071.8921					
	SEMO	440205.2909	5509373.9095	3183732.3274					
LHAS	LHAS	-106937.6521	5549269.5906	3139215.7633	0.4120	0.0646	-0.1022		0.43
	KARD	1133437.8252	5157218.2552	3575065.7706					
	SEMO	440209.2764	5509367.7072	3183724.5343					

Bases GPS: LHAS->KARD / LHAS -> SEMO

			DX	DY	DZ	VX	VY	VZ	Error base (m)	
LHAS	KARD	LEICA	1240373.3092	-392053.5577	435849.6254					1371.93
		IGN-E	1240375.4773	-392051.3354	435850.0073	2.1681	2.2223	0.3819	3.13	1371.93
LHAS	SEMO	LEICA	547147.4589	-39900.8368	44510.0607					550.4
		IGN-E	547146.9285	-39901.8834	44508.7710	-0.5304	-1.0466	-1.2897	1.74	550.4

Soluciuns ITRF2000(2005.55)

			DX	DY	DZ	VX	VY	VZ		
	KARD	LEICA	1133435.2451	5157215.9683	3575065.4909	4.1039	-5.2203	-6.4012		9.22
		IGN-E	1133437.4132	5157218.1906	3575065.8728	-0.4120	-0.0646	0.1022		0.43
	KARD		**1133436.3291**	**5157217.0795**	**3575065.6818**					
	SEMO	LEICA	440209.3948	5509368.6892	3183725.9262	4.1039	-5.2203	-6.4012		9.22
		IGN-E	440208.8644	5509367.6426	3183724.6365	-0.4120	-0.0646	0.1022		0.43
	SEMO		**440209.1296**	**5509368.1659**	**3183725.2813**					

	Longitud	Latitud	Helip	Std	N#1	N#2	Horto	DH	Std
KARD	**77.604783656**	**34.278988633**	**5335.8980**	**1.847**	**-23.4300**	**-23.4450**	**5359.3355**		
SEMO	**85.431662253**	**30.110208417**	**5536.0000**	**1.111**	**-29.1000**	**-29.1080**	**5565.1040**	**205.7685**	**2.16**