

Real Ground Stations

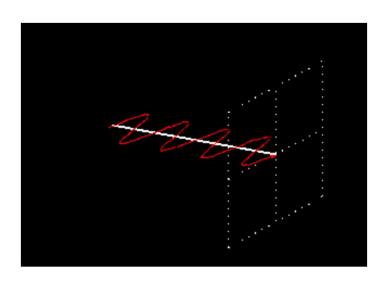
Link budgets in reality

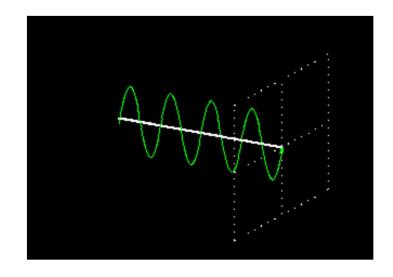


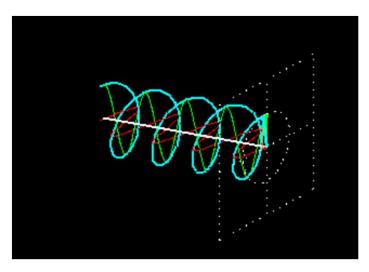
							RECEIVED POWER MARGIN	4B	12.3	O/L HOD INDIC	ES (Adv, Fav r	ofor boro to C	arrier Rec.)							
Programme and the second							MEAH-3*SIGMA MARGIM - u.c. RSS	4B 4B	#HAP	TELEHETRY			•	radph	1.57	1.73	1.41			
PROJECT:	PROBA-3						RZ S/Ma (at receiver input)	4BHz	70.0	RANGING sier	-1			ead ph	1.11	1.01	E 1.01			
LIMK ID:	ESA 15 m (SA	S) REDU-1/ TC	(kbpr)- 1.00 , TM (kbpr)- 256.00/	au RANGING		U/L MOD INDEX (Adv and Fav refer to Carrier Rec)		-	RANG. TONE TC is RG-Vides				rad ph rad ph	1.11	1.11	111			
Bafura salacting the ground station name in the bo	nx - click on the	Update Graus	d Station List	Update	Gound Station List		TELECOMMAND TELECOMMAND SUDCARRIER	ead ph	1.11	Haiar lades	2000 -2000			radgh	1.11	1.11	1.11			
SPACE SEGMENT			DATA TRANSMIS	SION			RANGING SUBCARRIER		1.11	CARRIER RECO				-	6.0		16.17	IHAHE?	IHAHE2	
SPACECRAFT	Caranagraph Sp.	acocraft	TELECOMMAND		20					PLL PAHDWIDT	TH 2'91			H.	111.11	221.01	40.0	EHAHE?	EHAHE?	TRI
ORBIT	High Elliptical Or	bit	TC Data Rato (kbps)	tinene .			CARRIER RECOVERT	10	2,12	PLL BAHDWIDT REGLOOP S/H				10H.	23.81	23.42	22.55	BHAHE?	HAME?	TRI
ALT (1000 Km)	60.52400		TC Mad Index (rad)	100	╛.	and the second	PPL [1], assessored AGC [2] assessored AGC [3] 7	-	4.00		RECOT. MARG			- 10	-35.13	#HUH!	15.29	AMAME	#HAME?	440
ALTITUDE (AU)	0.0004		TC Mad Schome	NR2-LIFSKIFM		#NAME?	AGC IMPUT PANDWIDTH	LH.	2.50	MEAN-3	"SIGMA			4B	#HAME?	ac (113)(113)	19.29	у внини:	у энине:	CHU
GROUND SEGMENT	ESA 15 m (S/S) REI	was III .	TELEMETRT		•		PLL-PDW 2'Pla Gazerier angulberak THRESHOLD C/H is 2'Pla	H. 10	100.0	MARGIN	1 - u.c. RSS			4B	*HUM!	IHUH!				
GROUND STATION ELEVATION ANGLE (40-4)		1 -1	TM Data Rato (kbpr) TM Mad Indox (rad)	256,000	Symbol Rate (krps Cody for NR2VF5K		PLL DAMPING @ sarrier angullarest	277.00	8.79	ELEMETRT RE							100	-		
ELEVATION ANGLE (404)	Tr.	1	TM Mad Index (rad)	PCM-SPL/PM		F77BF2F1F77	Efficial PLL-BDW 5.B1	H.	46.6	TLH HODULAT	TION LOSSES OR TECHNICAL LOSSES			10	6//	1.11	1.11	BHAHE?	HAME?	TRI
FREQUENCY OF OPERATION				3.00			H ACO SWEEP RATE Effect PLL-DDW 2'DI	40H-	11.5 25.8	CONCAT CODE	ING GAIN			10	11.41	41.41 56.11	4.4	BHAHE?	SHAME?	DET
U/LFREQUENCY (GH±)	2.0250		TM Subcarrior type	2	[Sinwaidal (1), Sa	uaro (2), Nano (3)]	BP-LIMT SYSTEM LOSS IMPLEMENTATION LOSS	10	1.01	DIT RATE CODE RATE				10H-	54.11 1.44	1.44	1.66	IHAME?	SHAME?	4,742
D/L FREQUENCY (GHz)	2.2000		TM Subcar frog (KHz	V0.00	Ratio Fruberar/Rr		C/HIHPLL-9DW	10	41.5	REGENHAJFE FLYHA	ER-4E-7], I-S			10	3.11	3.41	3.41	BHAHE?	SHAME?	DET
99% IM BW accusency (PCM/PSK/PM.rcheme)			Cading?	FER-1E-7, Concut	mated,EbNe-3.1 dB, le	terlessing-5	REG C/H is PLL-PDW	10	16.6	[verenev	RT MARGIN			JR.	4.47	2.57		ANIMES	Z ANAMES I	
Far Sino subcarrior (kHz)	See CCSDS401(4.2.2)	RAMGING?(7/a)	no		_	CARRIER REC. MARGIN MEAN-3"SIGMA	4B	30.5 #HAP	MEAN-3	"SIGMA			4B	1.87 ************************************	-2.56	6.02	# #HAME?	*HAME?	
Far Square subcarrier (kHx)	9742		RGU/L Med Ind (rad)	n on			MARGIN - u.c. RSS	4B	29.5	MARGIN	1 - u.c. RSS			4B	*HUH!	IHUH!				
Recommedation: Turn around ratio	221/240		RGD/L Mad Ind (rad)	0.00			TC RECOVERY		1	OHE RECOVER										
Mizzian Category	Space Research	4	RG Subcarrior type	1	[Sinwaidal (1), Sq		MODULATION LOSS	10	4.12	TONE HODULA				10	1.11	1.11	1.11	H.RG	H.RG	TRI
			Ranging System	1	[MPTS (1), TONE (2	01	REGEL/H.	15	2.00	S Teer /He				20H.	H.RG	H.RG	H. RG	H.RG	H.RG	161
							TC MARGIN	4B	31.‡	S Teer /H for t	1888 - H. Lang 1977 - Ang 1977 - Ang 1978			-H-	H.RG H.RG	H.RG H.RG	H.RG H.RG	H.RG H.RG	H.RG H.RG	
INK BUDGET MARGIN SUMMARY		DESIGN	HEAH-3 SIGHA	DESIGN -			MEAH-3"SIGMA MARGIN - u.c. RSS	4B 4B	SHAP	HPTS HAX RE	(a Loop-PDW ["]			-H-	H.RG	H.RG	H.RG	H.RG	H-RG	
				WORST CASE				-			March Control			Chrob	Zaging Tour and reason	***	12.11	P INHTEX	P INHTIES	DET
UP/L CARRIER RECOVERY		30.59	\$NAME?	29.51			RMG CHAMMEL TC:: RMG-V3632 V-1/M-1			COMBINED CAL	RRIER JITTER			A55-4-A5		L	T.	-	7	
TC RECOVERT DOWN/L CARRIER RECOVERY		31.89	#NAME?	30.87 \$NUM!			TORE MODULATION LOSS RHG HOISE SHOWIDTH	JD LH.	Heran	UPLIHK CARRI	IER JITTER			des	1.31	1.53	1.24	EHAHE?		
TH RECOVERT		1.87	#NAME?	#NUM!	1		RHG HOISE DHOWIDTH	JDH.	31.0	DOWNLINK CA	RRIER JITTER CARRIER JITTER			des des	731.51 731.51	HUH:	2.28	SHAME?		
							IMPLEMENTATION LOSS SITure I/H in Vidental	10	Heren	COMERENT TR	RAHSPOHDER				2.88	0.0000	546.00	0.000		
SASIC UPLINK							SITunoj/H in Vidonka SITCJ/H in RG-Vidonka	49	1.01	TRANSMIT CA	TER DOW 2"0 [""]			Arq Ha	5.00	1.H 11.H	1.11	2.11 6.51		
		пон	497					•		RX COMPINED	CARRIER JITTER							IHAHE2		
			MPY .	PAT	HEAR	TAR PDI	STC/HI-RG-VIA-LA		1.11					479	721.81	r mun.	2.22		_	
TATION TZ G/STXPOWER	19//	8.1	8.1	25.3	HEAR	TAR POT				5/H is RANGIN				171	77.31	r mun.			_	
G/S TX POWER	1947 W	25.1	8.1	25.3 627	IHAME? IHAME?	IHAME? TRI	BASIC DOWNLINK			S/M in RANGIN S(tone)/Nin S(TC)/inRG-W	n Vidoabd			10 10	Haranging H/A	Heranging H/A	Haranging H/A		-	
G/STX POWER CIRCUIT LOSS TX ART GAIR	10W W 10 10:	8.1 99 1.39 6.19	25.1 311 4.81 67.53	8.3 67 1.8 4.8	HAME? HAME? HAME? HAME?	SHAME? TRI SHAME? SHAME? UHI SHAME? UHI			<u></u>	S(tane)/Nin	n Vidoabd			10 10	Heranging H/A	Harverging H/A	Harranging H/A		_	
G/STX POWER CIRCUIT LOSS	70 W	25.1 331 1.33	8.1 111 1.11	25.3 427 1.15	HAMES HAMES HAMES HAMES HAMES	IHAME7 TRI IHAME7 IHAME7 UHI	BASIC DOWNLINK	1941 14 11	- I.J	S(tane)/Nin sjTcj/ieRg-V	n Vidoabd Sdrabd)		10 10	Heranging H/A	Heranging H/A	Heranging H/A		_	
G/STXPOWER CIRCUIT LOSS TX MRT CAM MRT TX XXIAL RATIO	70 W	25.1 391 1.39 47.19	25.1 111 1.11 0.13 1.11	25.3 627 1.19 41.19	HAME? HAME? HAME? HAME? HAME?	HAME? TRI HAME? HAME? UNI HAME? UNI	BASIC DOWNLINK SPACECRAFT TE SPACECRAFT TE [Host, GREWIT 1055	W.II. 40	5.11 5.0	S(tano)/Nin S[TC]/ieRG-V	n Vidoabd Sdrabd	.ide4 ,ele4 kg H	PTS ia: MIH 1.25 a N	10	Heranging H/A	Heranging H/A	Heranging H/A		-	
CISTER POWER CIRCUIT COST TRANT COST ANT TA SOUR EATTO POWTHER COST EIRE-CUS	1000 100 100 100 100 100	25.1 391 1.39 67.39 1.51 1.41 72.58	25.1 311 1.13 0.35 1.11 1.41 24.32	25.3 427 1.15 41.35 1.11 1.32 73.48	IHAME? IHAME? IHAME? IHAME? IHAME?	HAMES TRI HAMES UNI HAMES UNI HAMES UNI HAMES UNI HAMES UNI HAMES UNI	BASIC DOWNLINK SPACEORAFT TZ SUCTE POWER [H] OPPL. CRECUIT LOSS [B] FROW CRECUIT LOSS	Walle	E.31	S(tono)/Nin S TC /inRG-V TCdrawler " Therequire	n Videabd 'ideabd			10	Haranging H/A	Haranging H/A	Harvaging H/A		-	
C/STXPOWCE CIRCUIT 103 TXANTCASH ANTTXAXXALBATTO PONTMICLOSS EIRP C/S	70 W	26.1 931 1.33 67.13 1.54 72.23	25.1 111 1.11 0.13 1.11	25.3 427 1.15 41.15 1.11 1.22 73.48	HAMES HAMES HAMES HAMES HAMES	IHAME? TRI IHAME? UHI IHAME? UHI IHAME? UHI IHAME? UHI	BASIC DOWNLINK SPACECRAFT YE SECTA SWEE [1994. CRICKIT 1055 [1] HOME CRICKIT 1055 [1] CAREL 1055 WAR, Annual	Walls 20 20 20 21	8.81 5.11 5.02 5.03 5.03 5.03	S(tono)/Nin S TC /inRG-V TCdrawler " Therequire	n Vidoabd Sidoabd Isaa aal isaladad Aasa Paadaidlk (laa			10	Haranging H/A	Ma conting McA	He senting H/A		_	
C/S TX POWCE CIRCUIT 103 TX ANT CAIH ANT TX AXIAL BATTO FORTITHE LOSS EIRP C/S TROPAGATION SHANT FARICC PATH 1055 ATTHOSPHERIC 1055	10 10 10 10 10 10 10 10 10 10 10 10 10 1	25.1 931 1.39 9.35 1.51 1.60 72.58	35.1 381 4.13 47.5 5.11 1.01 74.32	25.3 627 1.19 6.19 1.10 1.32 73.48	IMAMES	HAME? TRI HAME? UNI HAME? UNI HAME? UNI HAME? UNI HAME? UNI HAME? TRI HAME? GAU	BASIC DOWNLINK SPACEORAFT TE SECTE POWER IN OPPL. CIRCUIT LOSS IN INFORM CIRCUIT LOSS TOTAL CIRCUIT L	W.II. 19 19 19 19 10	5.11 5.11 5.51 5.51 5.51 5.51 5.51	S(tono)/Nin S TC /inRG-V TCdrawler " Therequire	n Vidoabd Sidoabd Isaa aal isaladad Aasa Paadaidlk (laa			10	Managing M/A	Ma conting Mca	He senting H/A		_	
CISTAR POWER CIRCUIT COSS TANT CONS TANT CONS TO THE COSS ETER COSS ROPAGATION SIANT TANCE PATRICES TO THE COSS	1000 100 100 100 100 100	25.1 291 1.39 2.39 1.53 1.60 72.38	55.1 301 5.03 6.05 5.01 5.01 5.02 55.22 55.22 55.32 5.05 5.01	25.3 427 1.15 4.35 1.10 1.32 23.38 52.22 191.65 1.15 1.11	IMAME?	HAMES TRI HAMES UNI HAMES UNI HAMES UNI HAMES UNI HAMES TRI HAMES TRI HAMES TRI HAMES GAU HAMES GAU	BASIC DOWNLINK SPACECRAFT YX SCCYNPOWER 4 DIPL., CRC.UIT 1015 3 IRIGALE (CRC.UIT 1015 3 CARELE (CRC.UIT 1015 VERR, servall 4 WWW. 1055E5	W.III. 19 19 19 11	5.01 5.01 5.01 5.02 5.02 5.03 5.03 5.03 5.03 5.03 5.03 5.03 5.03	S(tono)/Nin S TC /inRG-V TCdrawler " Therequire	n Vidoabd Sidoabd Isaa aal isaladad Aasa Paadaidlk (laa	a lbe Ta skain se lbe l	HPA	10	He resting	Haranging HAR	Heranjing H/A		_	
CASTER WOMEN CIRCUIT TOS TEANT CANN ANT TEXTER BATTO PORTITUDE LOSS ERROR ATTO SANT BANCE SANT BANCE FATE LOSS ATTORNEES LOSS INFORMERS LOSS INFORMERS LOSS INFORMERS LOSS	10 10 10 10 10 10 10 10 10 10 10 10 10 1	25.1 931 1.39 9.35 1.51 1.60 72.58	35.1 381 4.13 47.5 5.11 1.01 74.32	25.3 627 1.19 6.19 1.10 1.32 73.48	IMAME?	HAMES TAI HAMES UNI HAMES UNI HAMES UNI HAMES UNI HAMES TAI HAMES TAI HAMES GAU HAMES GAU HAMES GAU HAMES GAU HAMES UNI	BASIC DOWNLINK SPACECRAFT YZ LACT ROWER [10 DEL, CRICCUIT COSS [10] FROW CROCUIT COSS [10] CAREL COSS VOR. VOR. VOR. VOR. VOR. POWER DESIGNS CAMPAIL POWER DESIGNS CAMPAIL POWER DESIGNS CAMPAIL POWER DESIGNS CAMPAIL	Walls 40 40 40 40 40 40 40 40 40 40 40 40 40	5.33 5.31 5.31 5.30 5.39 5.39 5.39 1.40 4.40 4.41	S(tone)/Hin s)TC(/in RG-Vi ["]TC-toneler! ["]Tb-require [""]Zb-in the ba	n Vidoubd 18esha 18essal isoladd ed Loop-Doodwidth (Iwa andwidth of the jiller fo		HAMES INAMES	### ### ### ### ######################	Herening H/A	Herasing H/A	He casping		_	
CISTANDES CIRCUITOS TRANTCAIN ANT TAXIALBATIO PORTITICIOSS EIRE-CIS SANT TARICE SANTAGES ATTAGES ATTAGES ATTAGES ATTAGES ATTAGES COPOLAG ATT-CAMING-M-HP POLAGRICATOR ONLY-M-HP POLAGRICATOR ONLY-M-HP POLAGRICATOR ONLY-M-HP	10 10 10 10 10 10 10 10 10 10 10 10 10 1	33.1 391 1.33 0.39 1.31 1.40 72.58 35.31 96.33 5.87 4 1	55.1 311 5.13 6.13 5.14 1.44 24.32 65.22 5.32 5.31 5.31 5.31	627 L.B 427 L.B 4.B 4.B 4.B 4.B 4.B 4.B 4.B 4.B 4.B 4	IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED	HAMES TRI HAMES UNI HAMES UNI HAMES UNI HAMES UNI HAMES TRI HAMES TRI HAMES TRI HAMES GAU HAMES GAU	BASIC DOWNLINK SPACEORAFT YE SECTA POWER IN DIPPL CIRCUIT 1-05 INI POPEL CIRCUIT 1-05 INI POPEL CIRCUIT 1-05 INI POPEL CIRCUIT 1-05 INI POPEL CIRCUIT 1-05 OVERALL POWER 1-15 SECTA AND TO CALL POWER SECTION	Walls 40 40 40 40 40 40 40 Walls	5.01 5.01 5.01 5.01 5.01 5.01 5.01 5.01	S(tane)/Hin STC(ris Rd.v.	n Vidoobd ideabd lass and installed and installed and installed	1.51 P. 1.51	HAMES HAMES HAMES HAMES HAMES	HAX 1888 H	Maraning M/A	He reging H/A	He conging H/A		_	
CISTA POWER CIRCUIT LOSS TA ANT CHIN TA ANT CHIN THE CONSTRUCTION SHAPE THE CONSTRUCTION SHAPE THE CONSTRUCTION THE CONSTRUC	10 10 10 10 10 10 10 10 10 10 10 10 10 1	23.4 391 1.33 6.32 1.34 1.44 72.58 65.31 96.43 2.58 4.67 4.7 4.7 4.37 4.37	25.4 318 5.19 6.13 5.10 1.40 74.32 18.27 195.32 5.15 1.50 1.5	27.3 4.7 4.13 4.13 1.18 1.19 23.48 52.22 96.45 1.15 1.11 495.38	HIGHES	HEARTS UNI HEARTS UNI HEARTS UNI HEARTS UNI HEARTS UNI HEARTS CAN HEARTS UNI HEARTS HEARTS	BASIC DOWNLINK SPACECRAFT TE SECTE OF WEE IN DIPL. CIRCUIT LOSS IN REPORT CIRCUIT LOSS IN CARLE LOSS VARA, ****-LI IN VARA CONSTRUCTORS TOTAL CIRCUITS LOSS OVERAL LOWER LOSS CALD ***-I POWER DESIRTY ALS CALD ***-I SOCTE AND TOTAL CIRCUITS LOSS SOCTE AND TOTAL CIRCUITS LOSS OVERAL DOWNER LOSS CALD ***-I SOCTE AND TOTAL CIRCUITS LOSS SOCTE AND TOTAL CIRCUIT	Walls 40 40 40 40 40 40 40 40 40 40 40 40 40	5.31 5.11 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	S(tone)/Nin stret/ is Re-vi []TC desided []Tt require []"[20 is the La	n Vidoobd ideabd lass and installed and installed and installed	1.51 F. 1.51	HAMES HAMES HAMES HAMES	### ### ### ### ### ### ### ### ### ##	8/8	He require HVA	He congles He A		_	
CISTA POWER CIRCUIT LOSS TA ANT CRIMS ANT TA CRIMS ANT TA CRIMS ANT TA CRIMS ETER COSS FOR PAGE THE CRIMS FOR	10 10 10 10 10 10 10 10 10 10 10 10 10 1	33.1 391 1.33 0.39 1.31 1.40 72.58 35.31 96.33 5.87 4 1	55.1 311 5.13 6.13 5.14 1.44 24.32 65.22 5.32 5.31 5.31 5.31	25.1 427 1.13 4.31 1.14 1.32 23.41 1.22 196.45 4.15 1.11 195.33 43.63	IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED IMAMED	HAMES TAI HAMES UNI HAMES UNI HAMES UNI HAMES UNI HAMES TAI HAMES TAI HAMES GAU HAMES GAU HAMES GAU HAMES GAU HAMES UNI	BASIC DOWNLINK SPACEORAFT YE SECTA POWER IN DIPPL CIRCUIT 1-05 INI POPEL CIRCUIT 1-05 INI POPEL CIRCUIT 1-05 INI POPEL CIRCUIT 1-05 INI POPEL CIRCUIT 1-05 OVERALL POWER 1-15 SECTA AND TO CALL POWER SECTION	Walls 40 40 40 40 40 40 40 40 40 4	5.01 5.01 5.01 5.01 5.01 5.01 5.01 5.01	S(tane)/Hin STC(ris Rd.v.	n Vidoobd ideabd lass and installed and installed and installed	1.51 F. 1.51	HAMES HAMES HAMES HAMES	HAMES UNI	8/8	Heronica N/A	He zasşing He A		_	
CASTER WOMEN CIRCUIT STATE AND THE STATE S	10 10 10 10 10 10 10 10 10 10 10 10 10 1	15.4 211 1.5 0.91 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.	25.1 311 410 431 440 440 74.32 457 95.32 457 95.32 457 458 458 458 458 458 458 458 458	25.5 427 4.19 4.19 4.19 4.11 5.22 96.65 4.18 495.58 49.19	HIGHES	HEATED TAI HEATED UNI	BASIC DOWNLINK SPACECRAFT YE SACTAFORME [I DEPL. CR.COLIT.055 [I] CAREL LOSS WARRAL SACTAFORM [I WARR LOSSES OVERAL PROFESSES OVERAL PROFESSES CAN Part SACTART CAN EAST SACTART CAN EAST POWER DESERT ALSO CAN Part SACTART CAN EAST POWER DESERT ALSO PROPAGATION	Walls 40 40 40 40 40 40 40 40 40 4	5.01 5.01 5.01 5.07 5.07 5.07 5.07 5.07 5.01 5.01 5.01 5.01 5.01 5.01 5.01 5.01	S(tone)Min STC(r): RG.V. ["ITC devades] ["ITC devad	r Vidoubd Isaacal isaladad of Lusy-Pasduidth flus saduidth of the fitter for 181 181 181 185 -1	1. 1	HAHE? INAHE?	HAMES UNI	8/8	He resing H/A	He serging He in		_	
CISTA POWER CIRCUIT LOSS TA ANT CHIN TA ANT CHIN FORTING LOSS ERRO CES ROPAGATION SIANT BARROC	10 10 10 10 10 10 10 10 10 10 10 10 10 1	55.4 511 5.33 6.31 5.51 5.61 55.51 56.51 57.7 41 41 41 41 41 41 41 41 41 41	15.1 111 115 116 117 118 119 119 119 119 119 119 119	25.3 627 6.33 6.32 6.31 6.31 72.48 10.22 96.62 6.35 6.31 1.31 1.31 1.31 1.31 1.31 1.31 1.31	HAHES	HIGHES TAI HIGHES UNI HIGHES CAN HIGHES TAI	BASIC DOWNLINK SPACEORAFT YE SECTA SOWER [1] DEPLICACEUTI-105 [1] DEPLICACEUTI-105 [1] CARLE 1-05 [1] WAR (SOUTH-105 [1] WAR (SOUTH-105 [1] WAR (SOUTH-105 OVERALE MOVER -15-C ALIF-11 SOC HAT TACHE BAT FORTH DOWNTH -15-C ALIF-11 SOC HAT TACHE BAT FORTH DOWNTH -15-C ALIF-11 SOUTH -15-C ALIF-11 SOUTH -15-C ALIF-11 SOUTH -15-C ALIF-11 FOR DOWNTH -15-C ALIF-11 SOUTH -15-C ALIF-11 FOR DOWNTH	Walls 40 40 40 40 40 40 40 40 40 4	5.93 5.93 5.93 5.97 5.97 5.93 5.93 5.94 5.94 5.94 5.94 5.94 5.94 5.94 5.94	S(tune)Min STC(r): RG.V. [TC dender] ["TD red red ["TD red red ""TD red red 1.5.	r Videnth d Tidenth d	1.51	HAHEZ INAHEZ INA	HANTED UMINAMED TELLINAMED TELLINAMED TELLINAMED TELLINAMED TELLINAMED TELLINAMED TELLINAMED OCT.	8/8	Maraning Hris	Hermajing Heli		_	
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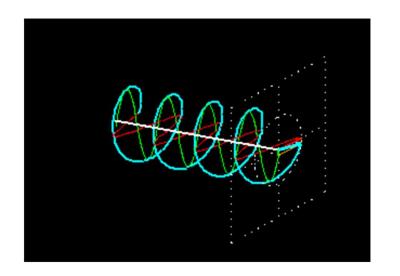
Extra considerations: Polarisation







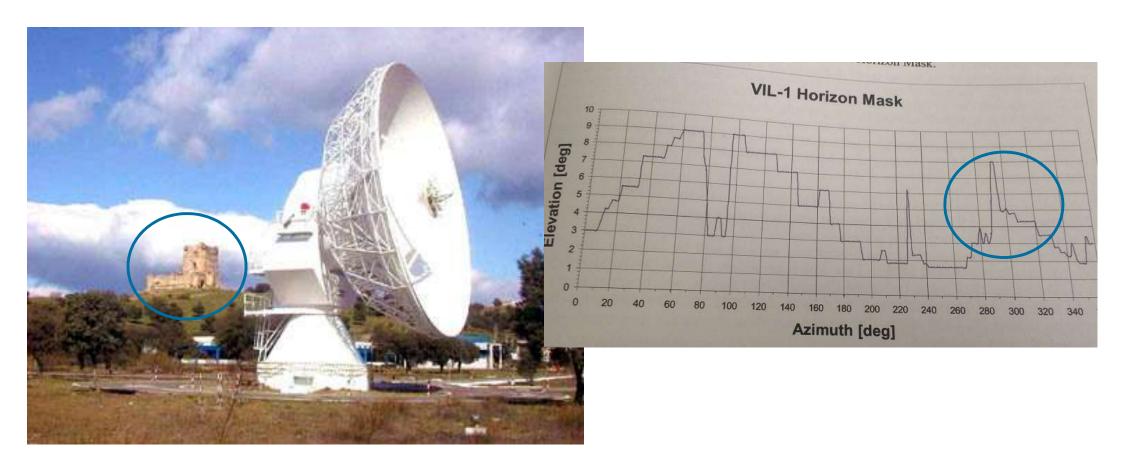




PROBA-2 RHC only

Extra considerations: Horizon Masks





Extra considerations....



Moving the antenna: pass profiles, tracking signal level, monopulse, program track

Station Timing: GPS, atomic clock etc

RF Testing: Near field problems, test towers, RF compatibility tests, RF suitcase

Cables: electromagnetic shielding, builders digging them up

Wind load

Air conditioning

Electrical grounding

Local RF licenses/laws, building regulations, health and safety rules

And more exotic problems....

Tropical rain





Ladybird Guide to Spacecraft Communications Training Course 2018

Snow, ice





Lightening protection





Ceberos suffered a few strikes in 2006 causing substantial damage - now improved

Infrastructure problems e.g. communications, power, road, water, security etc...





Strike in Kourou

Mass protests in 2017 prevented launch of Brazilian SGDC and Koreasat-7.

EUTELSAT flew its own 172b sat back to Europe as it cannot get to the launch site

ESA Academy | Slide 449

Local restrictions





A strange footprint





Belonging to...





How he got in...





Other visitors...





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Other visitors...





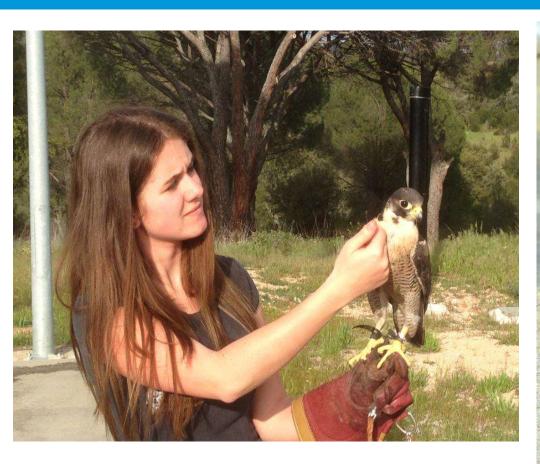
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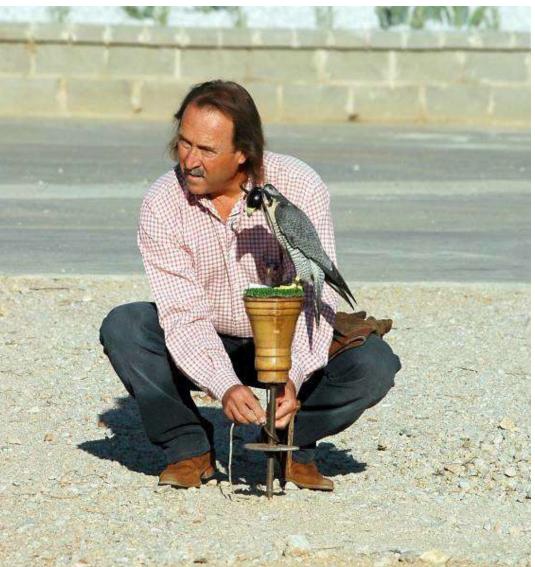




Birds







Fire





2013 in Cebreros

Fire





Remote Control





Politically and legally complex to have ESA stations in non member states



Recommendations



Keep link budgets simple to start with and for checking changes later. "I never received a correct link budget in all my years at ESA" (Rainer Timm)

Use the EIRP expanding wave and "physical area" collection viewpoint to keep your sanity and make trade offs

Be very careful of link budget spread sheets. Very useful and also very dangerous.

Invest in a good LNA and keep it cold and close to the feed

Do not forget the importance of the baseband signal shape – not intuitive

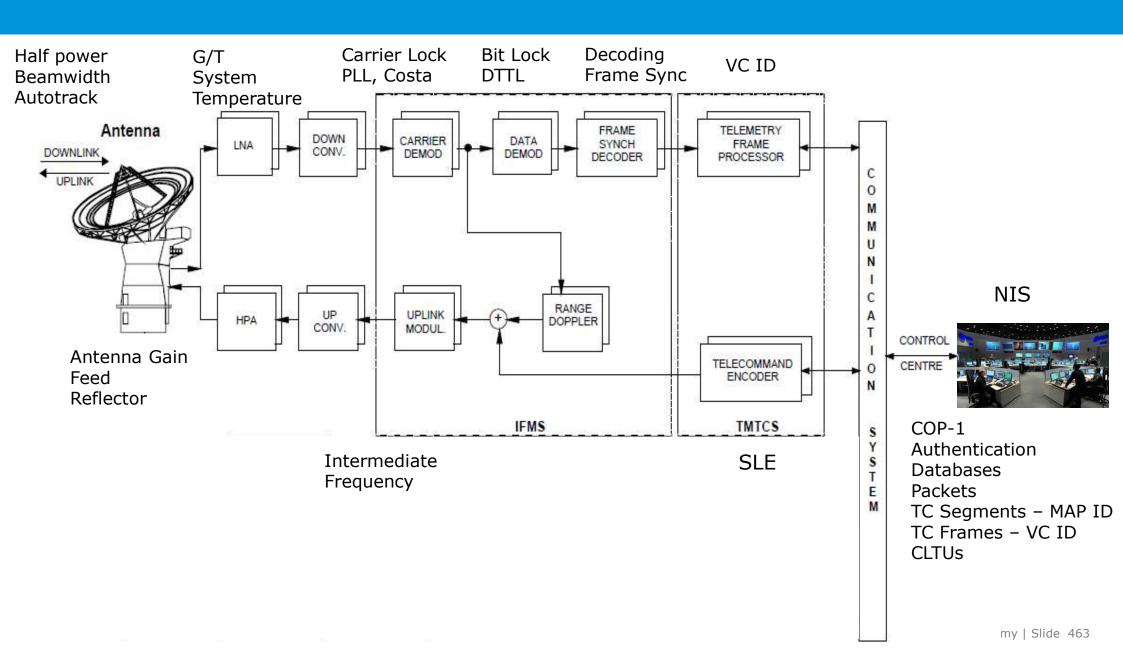
There is much, much more to ground stations than modulation, coding and protocols

Be aware that the problems of maintaining big dishes scale up to enormous proportions (pointing, wind, power, de-icing, cooling etc)

Nothing beats real testing in the field (Boris Smeds)

Have we missed anything?

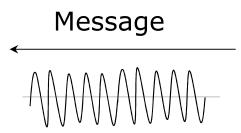




Conclusion









You can now design a communications system which is capable of retrieving that message!

Questions



