
ARLISS2006

CanSat : Da Vinci



Matsunaga Lab,
Tokyo Institute of Technology

Subsystem & Member

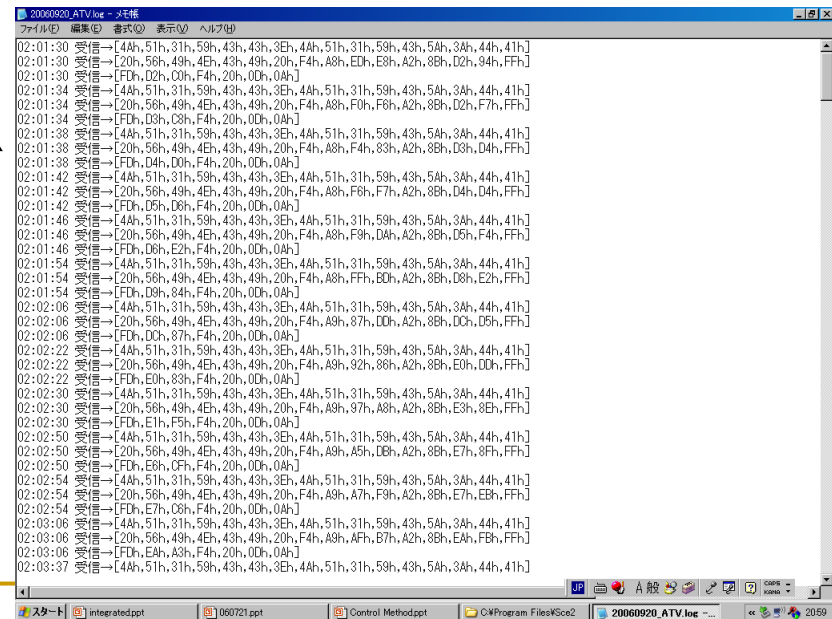
Subsystem	Member
Structure	Ueno
EPS	Konda
Comm	Ashida, Nisida
C&DH	Yamanaka, Maeno
ADS	Tanaka, Konda
GS	Maeno
Camara	Nishida

Mission

- 1st launch
 - ❑ ATV real time downlink (2.4GHz)
 - ❑ GPS data downlink (GMSK)
 - 2nd launch
 - ❑ Come Back
 - ❑ GPS data downlink (GMSK)
-

Result of 1st launch

- We could get 127packets (GPS Data)
 - ❑ But..We have not develop analysis tool yet, so we could not show you GPS trajectory.
- And... we could find out our cansat using packet GPS data!
- ATV real time downlink is not succeed.



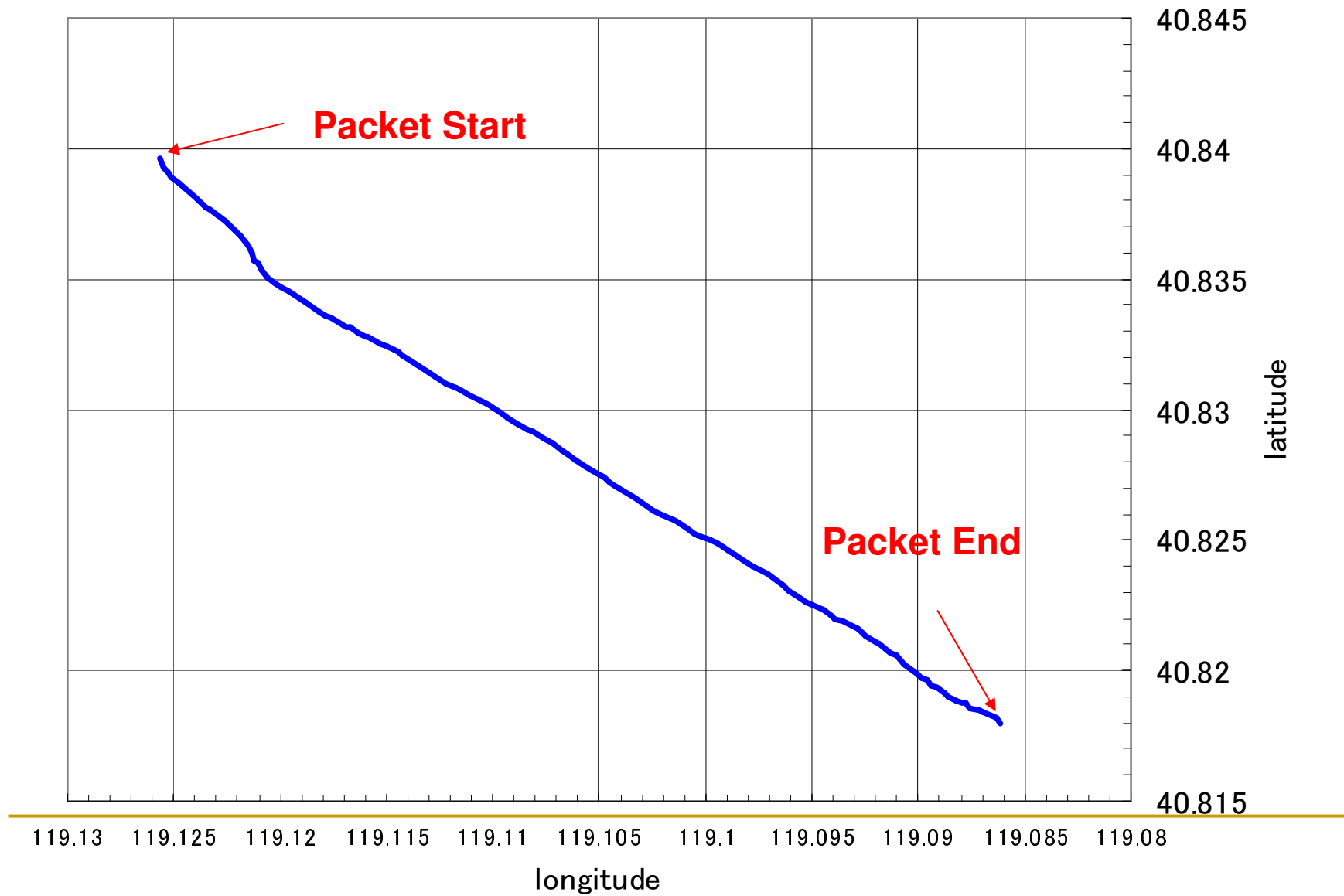
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20060920_ATV.log - メモ帳
ファイル(F) 編集(E) 書式(O) 表示(V) ヘルプ(H)
02:01:30 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:01:30 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A8h, EDh, E8h, A2h, 8Bh, D2h, 94h, FFh]
02:01:30 受信 -> [FDh, D2h, 00h, F4h, 20h, 0Dh, 0Ah]
02:01:34 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:01:34 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A8h, F0h, F0h, A2h, 8Bh, D2h, F7h, FFh]
02:01:34 受信 -> [FDh, D3h, C9h, F4h, 20h, 0Dh, 0Ah]
02:01:38 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:01:38 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A8h, F4h, 83h, A2h, 8Bh, D3h, D4h, FFh]
02:01:38 受信 -> [FDh, D4h, D0h, F4h, 20h, 0Dh, 0Ah]
02:01:42 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:01:42 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A8h, F6h, F7h, A2h, 8Bh, D4h, D4h, FFh]
02:01:42 受信 -> [FDh, D5h, D6h, F4h, 20h, 0Dh, 0Ah]
02:01:46 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:01:46 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A8h, F9h, DAh, A2h, 8Bh, D5h, F4h, FFh]
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02:01:54 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:01:54 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A8h, FFh, BDh, A2h, 8Bh, D6h, E2h, FFh]
02:01:54 受信 -> [FDh, D6h, 84h, F4h, 20h, 0Dh, 0Ah]
02:02:06 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
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02:02:06 受信 -> [FDh, DCh, 87h, F4h, 20h, 0Dh, 0Ah]
02:02:22 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:02:22 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A9h, 92h, 86h, A2h, 8Bh, E0h, DCh, FFh]
02:02:22 受信 -> [FDh, E0h, 83h, F4h, 20h, 0Dh, 0Ah]
02:02:30 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:02:30 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A9h, 97h, A8h, A2h, 8Bh, E3h, 8Eh, FFh]
02:02:30 受信 -> [FDh, E1h, F9h, F4h, 20h, 0Dh, 0Ah]
02:02:50 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:02:50 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A9h, A5h, DBh, A2h, 8Bh, E7h, 8Fh, FFh]
02:02:50 受信 -> [FDh, E8h, 0Fh, F4h, 20h, 0Dh, 0Ah]
02:02:54 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:02:54 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A9h, A7h, F9h, A2h, 8Bh, E7h, EBh, FFh]
02:02:54 受信 -> [FDh, E7h, 06h, F4h, 20h, 0Dh, 0Ah]
02:03:06 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
02:03:06 受信 -> [20h, 56h, 49h, 4Eh, 43h, 49h, 20h, F4h, A9h, AFh, B7h, A2h, 8Bh, EAh, FBh, FFh]
02:03:06 受信 -> [FDh, EAh, A3h, F4h, 20h, 0Dh, 0Ah]
02:03:37 受信 -> [4Ah, 51h, 31h, 59h, 43h, 43h, 3Eh, 4Ah, 51h, 31h, 59h, 43h, 5Ah, 3Ah, 44h, 41h]
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Result of 2nd launch

- We could get 114 packets (GPS Data)
 - So, we can estimate that our cansat was in the sky for 450[s]
 - We could get EEPROM data(2000[data]),and Cansat was under control.
 - Motor moved using as it was programmed . But the wind was too strong for us to control the cansat.
 - Trying Comeback by parafoil is so difficult when wind is strong...
 - All the system worked well. But our cansat couldn't approach the target point.
-

Locus Chart

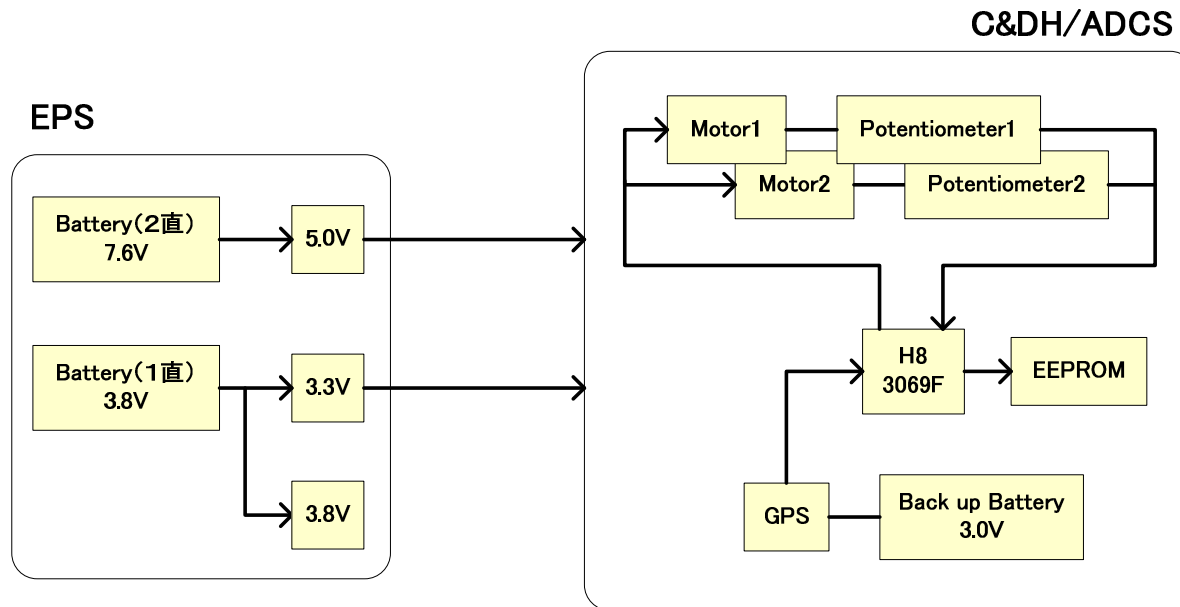
locus chart



Next section

Detail about subsystem

System block diagram for Come Back

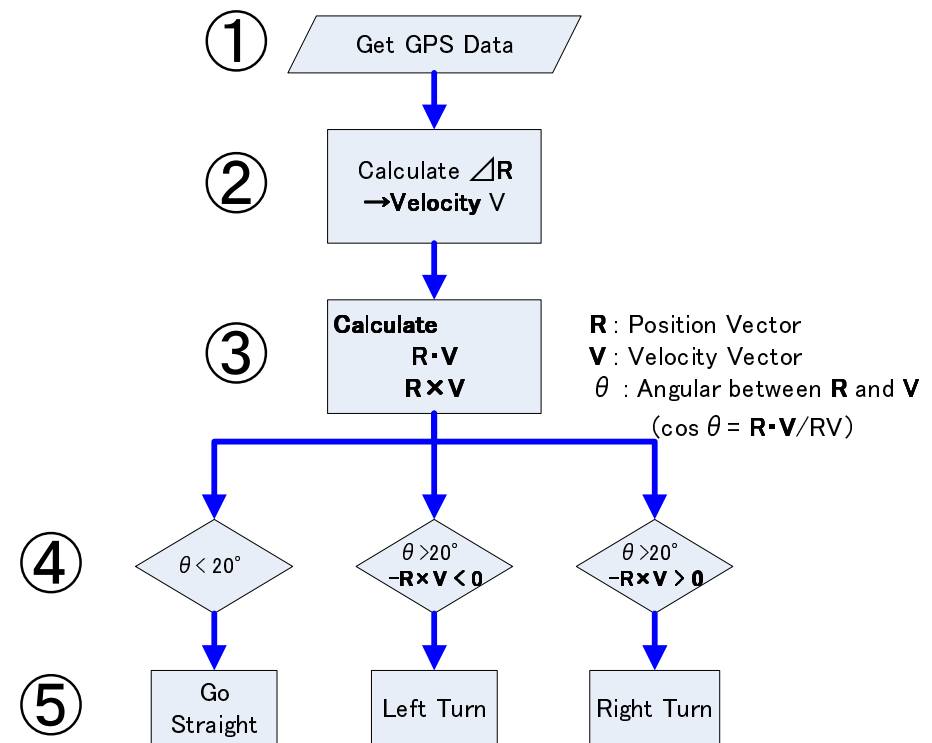


GPS data and potentiometer data are stored in a EEPROM.

Control Method for Come Back

- Our method to control CanSat was very simple. We got GPS data and then calculated its velocity. The value of $\mathbf{R} \cdot \mathbf{V}$ (dot product) and $\mathbf{R} \times \mathbf{V}$ (cross product) make the direction of CanSat apparent.

1. Get the GPS data continuously.
2. Calculate the difference of position to confirm the velocity of CanSat.
3. Calculate both dot product and cross product to get θ (angular between $\mathbf{R}$ and $\mathbf{V}$).
4. Change the control command depend on θ .
5. Result



EPS Power consumption estimation

Estimation :

Work after launch with flight pin · · · 1 hour,

Work before launch · · · 2 hours

		V[V]	I[mA]	P[W]	Time[h]	Total[Wh]	Switch
C&DH	H8-3069F	5	36	0.18	1	0.18	OFF
ADCS	GH-81(GPS)	3.3	37	0.1221	2	0.2442	ON
	Mortor	5	400	2	1	2	OFF
	AccelerateS	3.3	7.2	0.02376	1	0.02376	OFF
	MagnetS	3.3	14	0.0462	1	0.0462	OFF
COMM.	DJC7	3.8	320	1.216	1	1.216	OFF
	H8-2328F	3.3	100	0.33	1	0.33	OFF
					Total[Wh]	4.04016	

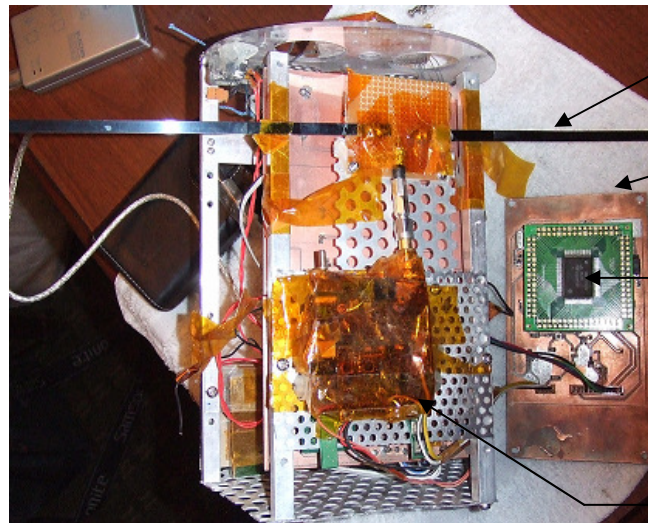
Camera · · · this subsystem has batteries its own

Communication Subsystem

■ Mission

- ❑ GPS data downlink by GMSK 9600 bps.
- ❑ GMSK modulation is used in Cute1.7 and it is expected to be used in our next satellite.

■ Photo



dipole antenna

Comm board

H8 2328

transceiver

Communication Subsystem(2)

■ System

- ❑ Receiving GPS data , the program in H8 2328 makes Ax.25 packet .
- ❑ The packet is sent to the modem and it is modulated to GMSK signal .
- ❑ The signal is sent by transceiver (DJ-C7 , Alinco) which is remodeled by us.

■ Result

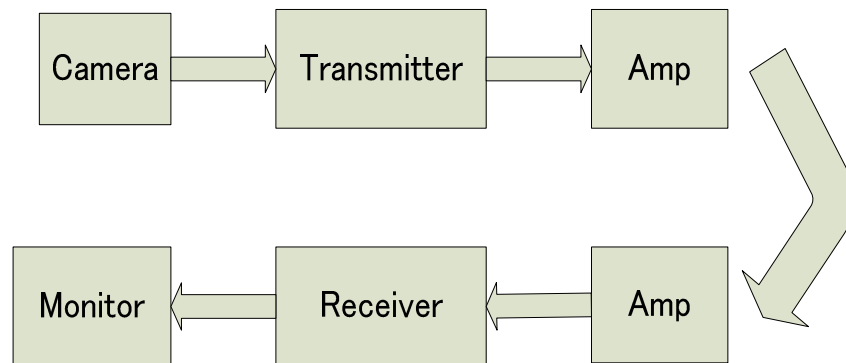
- ❑ In both flights , we successfully got GPS data .
 - ❑ We could decode almost all packets.
-

Camera

■ Mission

- ❑ ATV downlink by 2.4 GHz.

■ System



■ Result

- ❑ We could not get movie...
- ❑ Maybe because our cansat went so far away, so the signal did not reached .
- ❑ But in the balloon experiment in JAPAN , we successfully received movie .
- ❑ So we confirmed the system works correctly.

Thank you for your attention

