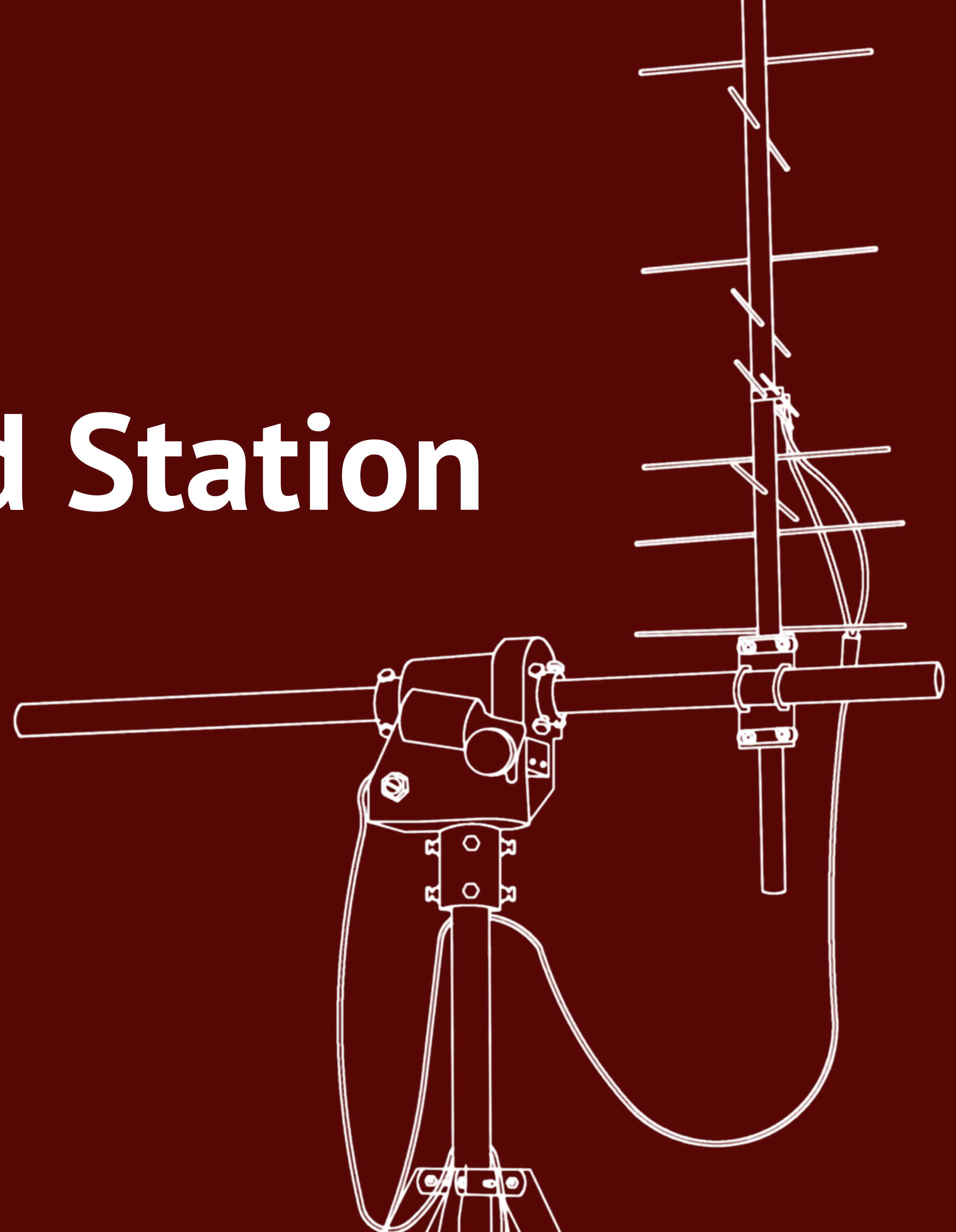


ECE 492 – Winter 2015

Satellite Ground Station

Andrew Keller
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Jacob Ortt
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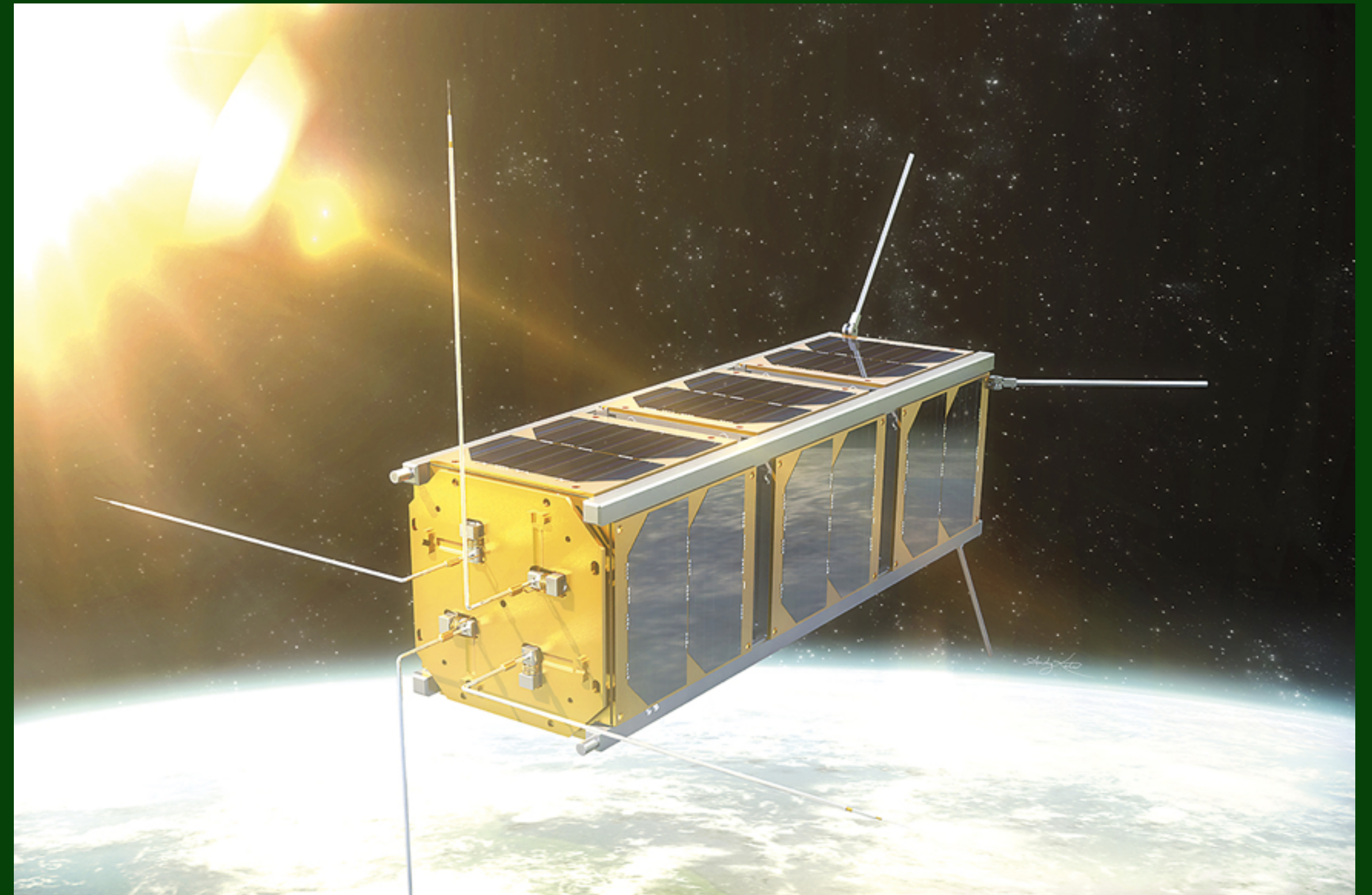
AlbertaSat Refresher

Satellite: Ex-Alta 1

- Alberta's first satellite

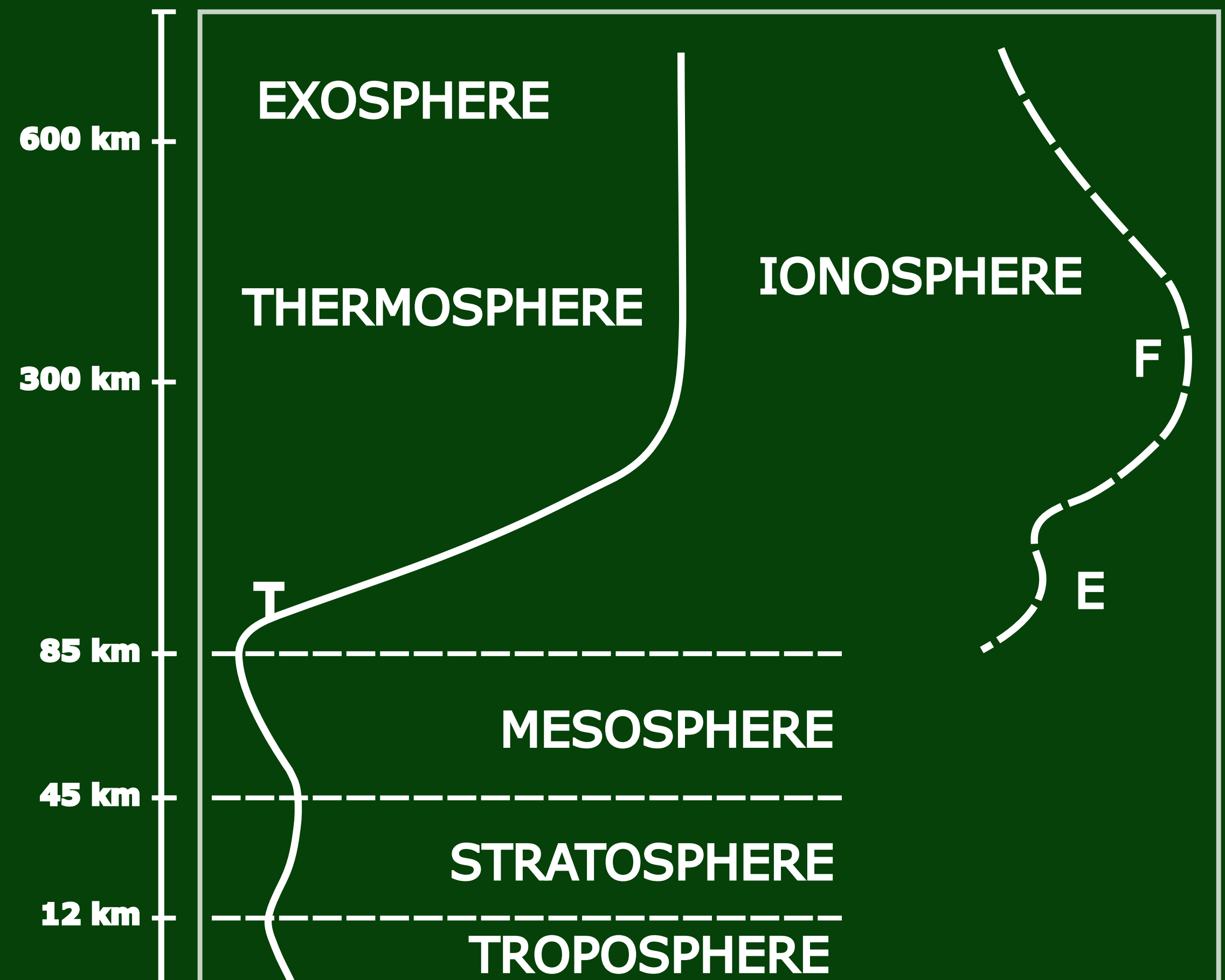
Mission: QB50

- collect scientific measurements in lower ionosphere



Mission Details

- 300-400 km
- Fluxgate magnetometer and Langmuir Probe
- ~2 year orbit



Objectives

Automated & integrated solution to track satellite and communicate with it.

- Point antenna at and track satellite
- Tune radio to satellite's frequency
- Store and decode signals from space
- Send commands to satellite when it passes

Tracking

Communications





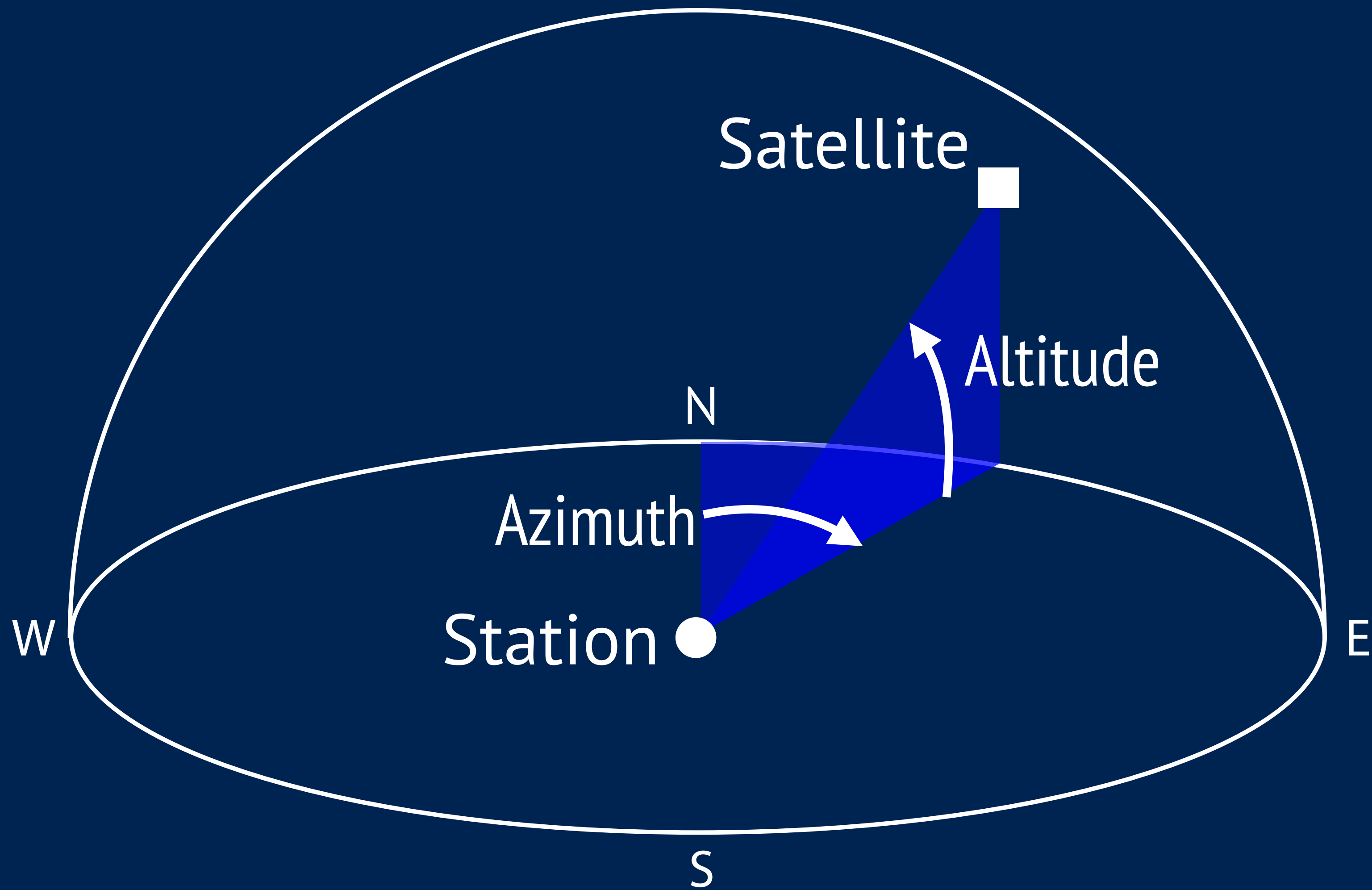
Orbit Prediction

- Satellites tracked by NORAD
- Orbital elements + time + location
→ azimuth and altitude

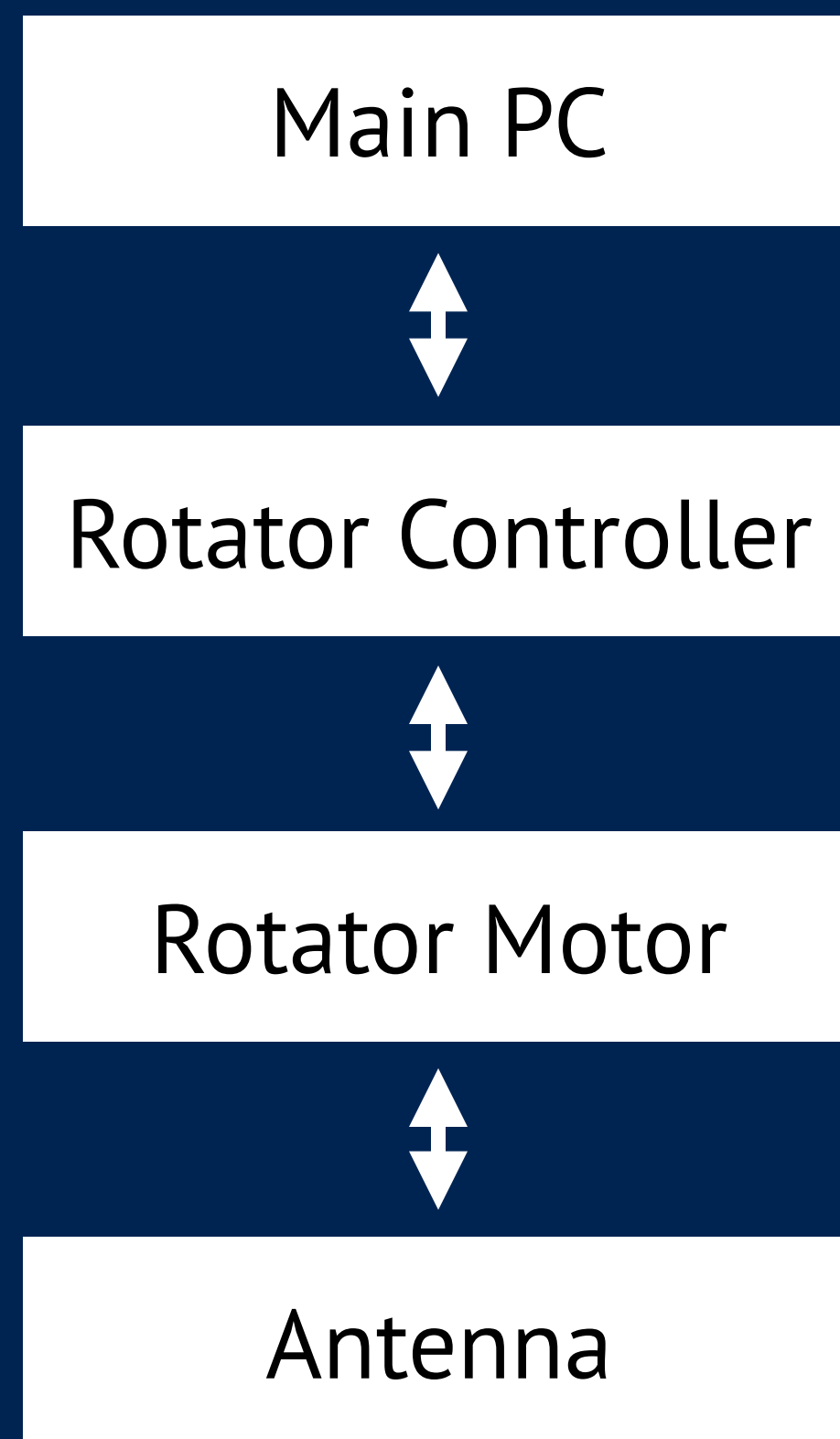


QB50P1

1	40025U	14033R	15097.15808165	.00003222	00000-0	36684-3	0	9997
2	40025	97.9587	357.3098	0014668	59.2887	300.9780	14.86830496	43246



Ground Station Design

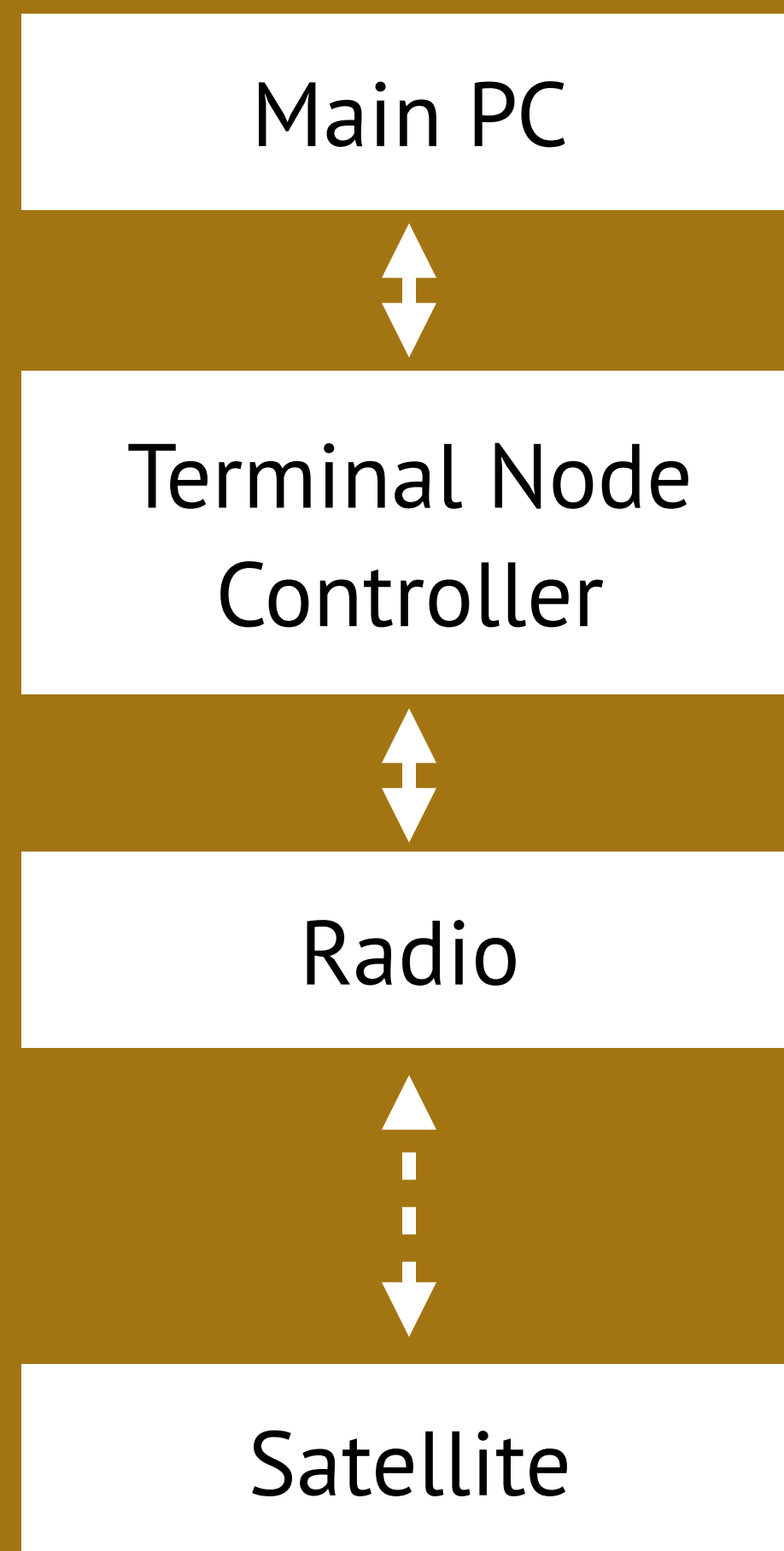


- Download orbital data from web
- PC predicts satellite passes
- Send (altitude, azimuth) to controller
- Controller turns rotator





Communications Overview



- Ultra High Frequency (~430 MHz)
- Focus on downloading scientific data
- Two types of commands:
 - real time
 - scripted

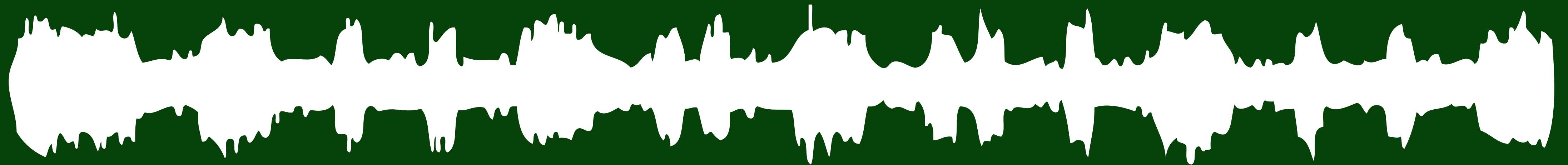
CubeSat Space Protocol

- Similar to IP, but lighter weight
 - 32 bit vs. 160 bit header

Bit offset	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Priority		Source				Destination				Destination Port				Source Port				Reserved				H M A C	X T E A	R D P	C R C						
32	Data (0 - 65535 bytes)																															

Communications Demo

Results



T O K Y O

8-52-11 MINAMI-SENJYU ARAKAWA-KU TOKYO-TO JAPAN

Questions?