2009 CubeSat Workshop

Frequency Coordination Update

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Satellites Completing Frequency Coordination Since Start of Process in 2003

- Total of **93** Spacecraft Coordinated
  - Satellites Specifically Intended for General Amateur Community Utilization: **9**
  - Satellites Intended for University Use with Some Amateur Community Utilization: **84**
  - Satellites Coordinated in the Past 12 Months: **25**

Satellites Currently In Coordination Process

- Total of **21** Satellites Currently In Frequency Coordination.

Satellite Coordination Processing Time
- During Past 12 Months -

- Minimum Processing Time: 10 days
- Maximum Processing Time: 10 months
- Average Processing Time: ≈ 2 months

[NOTE: 10 months is BRIEF Compared With FCC Processing Time Required for Most Space System Applications]

Reasons for Longer Processing Times

- Peak Volunteer Workload (There are now about 7 people involved, meeting once per 2 weeks via SKYPE)
- Applicant Response Times to IARU Coordinator Questions
- Missing Key Information on Application:
  - Applicants Don't Always Read the Filing Information and Don't Understand the ITU and IARU Processes.
  - Applicants Do Not Realize the Importance Place on the Ability of the Satellite to Terminate its Transmissions – HARD ITU Requirement.
  - Applicants Do Not Realize the Requirement for ITU "Advanced Notice" Procedure in Most Countries. [NOTE: FCC still ignoring this issue.]

Common Issues With IARU Frequency Request Form Submissions

- You must show “the world” (via the IARU Coordinator) that you have positive control of your transmitter at all times and with reasonable response times.
- You must differentiate between signals generated within you system for TC and TM and other emission sources.

[NOTE: This amounts to knowing the difference between Sections 4 c/d and Sections 5a and 6a of our form.]

You must determine if your satellite requires ITU Advanced Notice by your Frequency Regulatory Administration.

[NOTE: The FCC is currently ignoring this requirement for amateur satellites.]

Applying for Frequency Coordination

- Must Have:
  - Project that Complies with Rules of the Amateur Satellite Service
  - A Properly Licensed Radio Amateur Who Will Operate the Satellite Control Station.
- Ready to Apply?
  - Click on www.iaru.org
  - Click on “Satellite Service”
  - Click on “Frequency Coordination”
  - Submit Application Form to: IARU Satellite Advisor at satcoord@iaru.org

Some Feedback from the Amateur Radio Community

- Based on Listening to Several Cubesats -

- Using the SAME FREQUENCY for Uplink and Downlink is still viewed as a bad idea based on the ability to control the spacecraft under non-nominal conditions. -THINK POSITIVE CONTROL.
- Cubesat data formats generally have lots of gaps in transmission to save power. This is understood but, this makes the problems of tracking/tuning/decoding data very hard for any ground station (amateur and university alike).
- From the amateur radio perspective the most successful cubesats have been the Japanese spacecraft using 80 mW continuous transmission systems. These can be received well with a good pre-amp and a 12 element crossed Yagi beam antenna.

Some Feedback from the Amateur Radio Community
- The Tale of Two Texan Cubsats -

- In Terms of Working With the IARU Frequency Coordinators
  - GOOD: BIVO-1, Univ. of Texas at Austin
    - Coordinated in 1 month
    - Responsive Team
    - No Worries
    - Operating within 437.4 MHz range
  - BAD: AggieSat- Texas A&M
    - Did not make IARU Filing
    - Used Frequency in Transponder Downlink Portion of UHF Band (436.25 MHz)
    - Did Not Publish Telemetry Standards or Decoding Information
    - We do not know if ground station is operated by a licensed radio amateur

Some Important Issues (1):

- FCC Orbit Debris Report & Order
  - FCC Issued R&O Requiring All Space Services to Submit Orbit Debris Mitigation Plan as Part of Application.
  - AMSAT-NA Filed a Petition for Reconsideration Stating FCC Had No Authority to Act on Orbit Debris Under Federal Law.
  - AMSAT-NA and FCC Met to Discuss in May 2005 and lost on this issue.
  - FCC Requested that Future Amateur Satellites (and Particularly University Satellites) NOT Use Orbits in the Range 600 km to 2000 km Altitude

Some Important Issues(2):

- FCC Has Prevailed On This Issue
  - Current Situation is Uncertain as to what University Projects should do.
  - AMSAT Needs University Organization(s) to Become Politically Active in This and Other Regulatory Matters Which Are In Their Own Interest.
  - AMSAT-NA Invites University Organization(s) to Actively Work With Us to Prepare Arguments Supporting Our Orbit Occupation Interests
  - POC: Dr. Perry I. Klein
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Some Important Issues (3):

- Universities Implementing New Missions Should Plan to Use:

1. 435 MHz Up; 2.4 GHz Down

2. 1260 MHz Up; 145 MHz Down

3. Higher Frequency Bands; Particularly in the C-Band at 5.6 and 5.8 GHz.

Summary

- Frequency Coordination Process Generally Working Well
- Universities Need to Become More Politically Active
- We Need Help With the Paperwork