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Persistent Decoy Payload Information for FCC

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Request for Reconsideration

In regards to our recent Dismissal without Prejudice on our Experimental License Dismissal Notification, File Number: 0675-EX-ST-2020, I would like to address the concerns.

JHU/APL performs research and development activities for all branches of the US military. If approved, our STA request would have evaluated an early concept demonstration in support of a US Navy ship protection system. This effort would then have transitioned to a government entity to continue the development and spectrum management under the military DD1494 process.

We understand the concern of not creating any malicious interference per CFR 47 US Code 333, and are requesting guidance on proceeding with a second, more restrictive application since our original request has been denied and finalized. In this new application we would further limit the time duration for event execution. We would further describe our interference mitigation strategy and waveform design, including the use of directional antennas operating low altitude under line-of-sight conditions and the lowering of our ERP by 20 dB from 400W to 4W. During actual testing, RF radiation will be toggled on only for several minutes at a time with and transmit duty will be limited to no more than 0.003%. We will also add instrumentation to the setup to verify it is responding to only our own test signal excitation, and not to external signals from beyond our test environment. It is noteworthy that our systems would not be emitting jamming/noise, but only repeat signals that have been received, adding a slight Doppler shift.

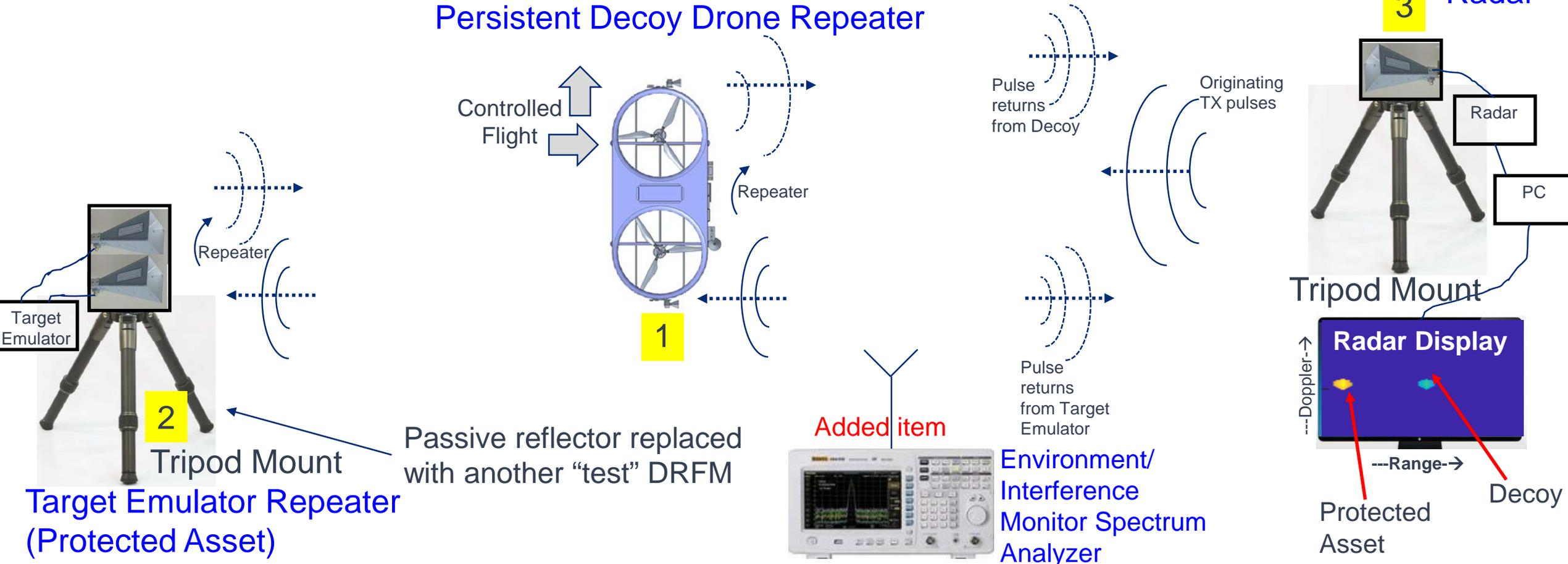
JHU/APL submits a number of STA requests to the FCC every year, and are grateful that the FCC is willing to work with us in supporting our mission to the DoD.

Your guidance on how to proceed following the denial of our original request is respectfully requested.

Test Description

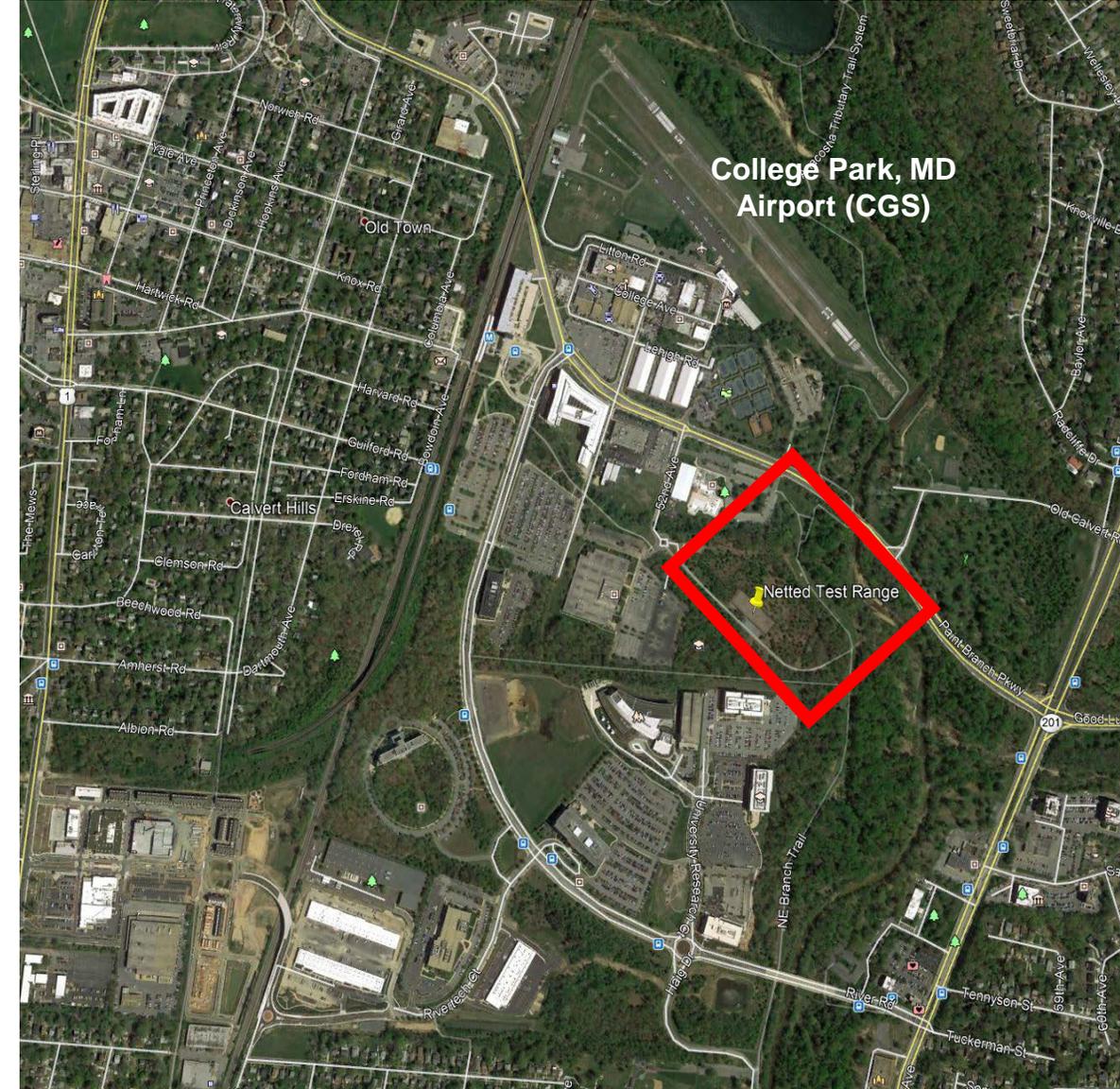
- 3 Systems, all with similar radiation characteristics
 - **1.** In Flight Persistent Decoy DRFM Payload (behaves as microwave repeater, with modulated responses)
 - **2.** Test Target: Ship/Target Emulator (behaves as a microwave repeater, with modulated responses)
 - **3.** Radar (transmits pulses and receives responses, to produce interactive Range/Doppler Plots)

Persistent Decoy Drone Repeater



Persistent Decoy Payload Test Event

- Purpose
 - Evaluate two Electronic Decoy's, one on a flying platform, one ground mounted response to a radar test signal within the confines of a physically "netted" 300x100x50 ft outside caged area (see pictures next slide)
- Method
 - Aim the radar at the two decoys inside the netted cage. The decoys will repeat the waveform, with various delays and Doppler shift. All antennas are aimed horizontally within the netted test range.
- Operational Area
 - 300 feet radius 38°58'27.23"N, 76°55'16.94"W near College Park, MD, on U of MD campus
- Decoys (2) and Radar (1) Hardware Description
 - Prototypes manufactured by JHU/APL
 - **0.10W TX Power, 4W ERP, Peak**
 - RF Freqs: 8.3, 9.6, 11, 12.5, 15.5 and 17 GHz
 - Emission: 50M0Q3N, **50 MHz LFM, ~ 100 KHz Doppler**
 - PRF: 100-200kHz, **0.003% Transmit duty cycle**
 - Antenna: 15 dBi, 31.2°/25.9° H/V Beamwidth
- FCC STA Request
 - Test window: 8/1/20 to 10/31/20
 - Flight durations are limited in time, ~15 minutes over which radiation will only occur for several minutes



UMD Netted Facility

- The Drone associated with this STA request will be flown in the University of Maryland Fearless Flight Facility (F3) near the College Park Airport (CGS)
- Description: Outdoor netted flight laboratory for testing UAS. 300x100x50ft (LxWxH).
- Features of use to support STA test
 - Do not need to adhere to FAA Part 107 UAS limitations.
 - Safe facility to test new UAS performance capabilities
 - Able to receive GPS satellites



Ground View



Satellite View

Clarifications

Addressing concerns of malicious interference per CFR 47 US Code 333:

- Systems are at X-band and above with line-of-sight directional antennas to reduce chance of interference
- Modify our original transmit power on the request from 400W ERP to 4 W ERP.
- RF power and receiver sensitivity will be further adjusted to the minimum levels to support the test activity to reduce potential of interfering beyond the test environment
- Our waveform has extremely low duty, of up to a maximum of 64 2us wide pulses with a 8.6us pulse repetition interval, followed by about a 5 s off period, for an effective transmit duty of 0.003%. Our Doppler modulation is below 100KHz for very limited frequency spill over.
- Systems will only be powered briefly during the test period, and RF radiation will be toggled on for a few minutes during the flight
- We will be monitoring the system to verify it is responding only to our own test signal excitation, and not any external signals from the environment.
- The systems are not emitting jamming/noise, but only repeat signals that our test radar generates, delaying the signal by 2 microseconds prior to transmission and adding a few KHz of Doppler shift to the received pulse
- A spectrum analyzer will monitor the test site to ensure our systems do not react to any external emissions to prohibit jamming other systems. The site will be surveyed prior to radiating to verify no signal activity is present at the test frequencies

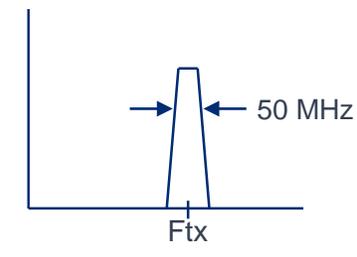
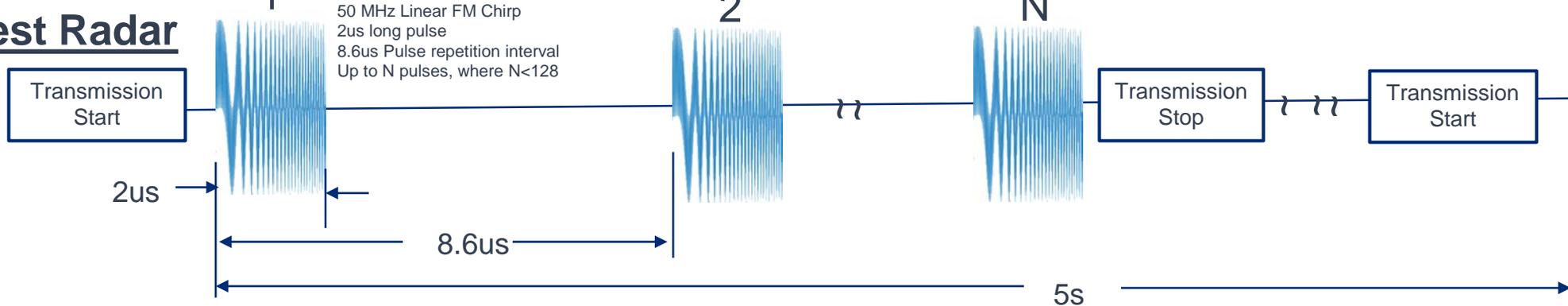
JHU/APL performs research and development activities for all branches of the US military. We design jamming systems for the services and are sensitive and knowledgeable to prevent interference for this field test. Our STA request is for an early concept demonstration in support of a US Navy ship protection system. This effort would then transition to a government entity to continue the development and spectrum management under the DD1494 process

System Waveforms

Time Domain

Frequency Domain

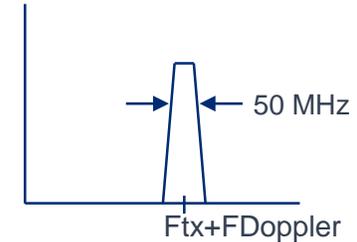
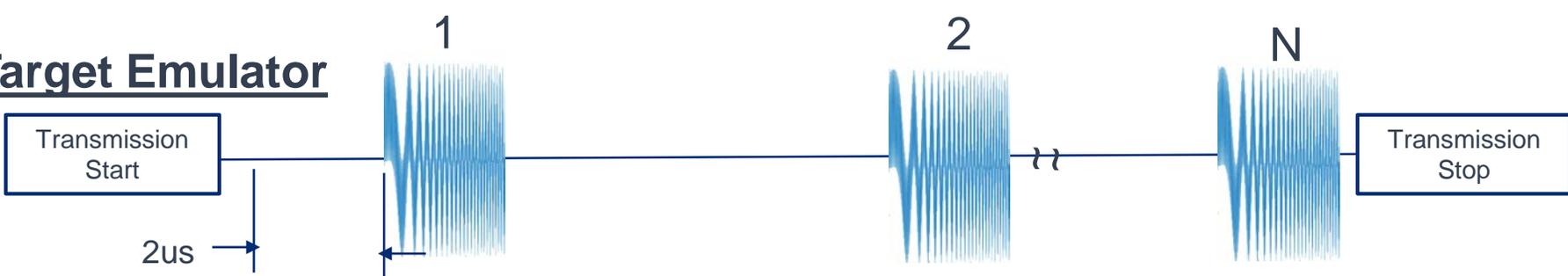
Test Radar



Transmit Duty = On/Off Time

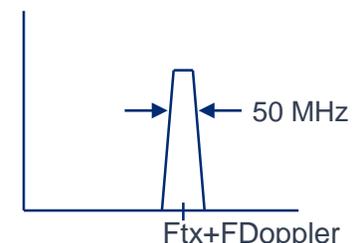
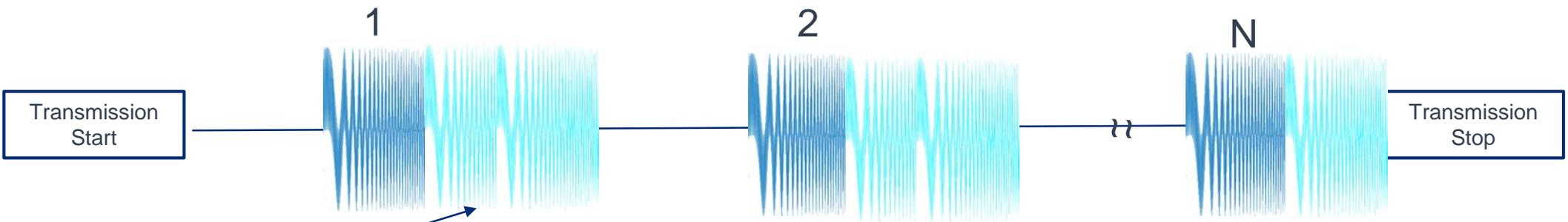
$$\text{Duty} = \frac{64 \times 2\mu\text{s}}{(64 \times 6.6\mu\text{s}) + 5\text{s}} = 0.0026\%$$

Target Emulator



$F_{Doppler}$ is < 100 KHz

Decoy Drone



$F_{Doppler}$ is < 100 KHz

Decoy Drone has option of step-repeating received pulse with Doppler shift



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