Real-Time Rate Distortion Optimization

- **General Overview:** Our primary goal is to transmit real-time (live) video with optimal visual video quality through the wireless network. We use Horus testbed to run our experiments.
- **Rate distortion optimization** problem aims to minimize distortion subject to rate constraints.
- **Rate** is determined by channel states using default IEEE 802.11 beacons.
- **Distortion** is a measure of the degradation in the video quality. It is measured using temporal and spatial distortion metrics.
- **Temporal distortion** metric is the ratio of the received video duration to the original video duration.
- **Spatial distortion** metric is the SSIM of sliced images from the received video w.r.t. the corresponding images sliced from original video.

**Horus Applications:**
1) Aerial stereo photogrammetry
2) Visual target detection
3) Recording 3D live video signal

**Network Topologies**
- Unicast Topology
- Multiple Unicast Topology
- Multicast Topology

**Flight Path**

**Experiments and Results**

- **Experiment 1**
  1(a) all video frames
  1(b) only i-frames
  1(c) LCRDO-Beacon for MPEG2

- **Experiment 2**
  2(a) low bit-rate
  2(b) high bit-rate
  2(c) LCRDO-Adaptive for MPEG2

- **Experiment 3**
  3(a) low JPEG quality
  3(b) high JPEG quality
  3(c) LCRDO-Adaptive for MJPEG

**LCRDO Algorithms**

Low Complexity Rate Distortion Optimization (LCRDO) Algorithms main blocks:
- **Packet Estimator:** estimates channel state using IEEE 802.11 beacons.
- **Packet Selector:** Selects encoder based on feed from packet estimator and using hysteresis.
- **LCRDO-Beacon:** switches between sending all frames and only i-frames.
- **LCRDO-Adaptive:** switches between sending at low and high bit-rate.