# Exploration of Data Transmission Strategies for UAVs

Høgskolen i Sørøst-Norge

## Data Links

### RC Data Link

The flight path of a UAV is controlled from the ground control station remotely. The commands used to control the direction, altitude, flying modes of UAV are called flight control data. A wireless remote control data link for UAV should be dependable, fast, supporting long-rang communication, no legal issue, *et al*. Radio frequency can totally meet these requirements, so it is widely used on small to middle-sized UAV remote control, this kind of data link is commonly referred as radio control (RC).

### Telemetry Data Link

During the flight of UAV, lots of flight status data are created by different sensors inside UAV. These data are very important and normally will be translate back to grand station to help the operator aware the flight status, so the data link transmitting flight status is also called telemetry data. UAV with autopilot controller often include the flight statues data into autopilot processing. There are a variety of data acquisition system and flight control systems that log and process telemetry sensor data.

### Application Data Link

As a floating platform on the sky, many applications, e.g. live onboard video stream, Wi-Fi access, Cellular network reinforcement, are implemented on UVA. Transmitting application data from UAV has became a hot topic. Except traditional radio frequency transmission, wireless networks has become the best solution for small-sized UAV application data transmission. Wi-Fi, Bluetooth, Cellular network are options on this list.

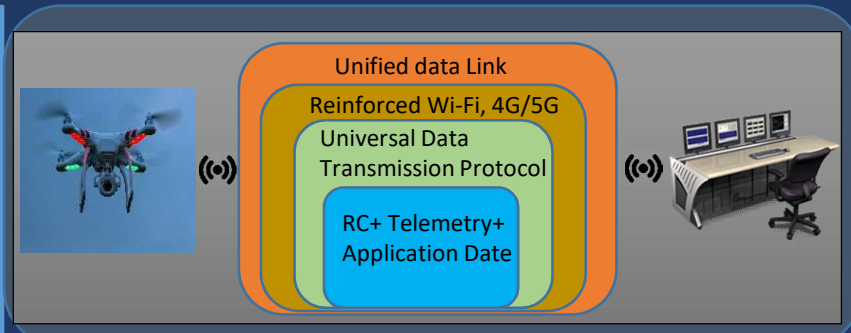
## Wireless Network For UAV Data Transmission

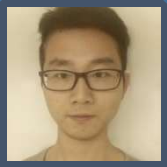
| | 802.11n | 802.11ac | Bluetooth 4 | 4G |
|---|---|---|---|---|
| Frequency | 2.4GHz, 5GHz | 5GHz | 2.4GHz | 2-8GHz |
| Speed | 150Mbps | 450Mbps | 25Mbps | 1 Gbps |
| Distance (max) | 250m | 250m | 60.96m | 3-5km |
| Latency (average) | 200ms | 200ms | 100ms | 5ms |
| Power | High | High | Low | Medium |
| Price | Medium | Medium | Low | High |

## Conclusions

- RC data link and Telemetry data link can be substituted by Application data link if it can support a stable, low latency data transmission service even at low speed;
- Application data link as a general data transmission link should be implemented on a universal data transmission protocol e.g., TCP/IP, UDP, MAVLink;
- The reinforced Wi-Fi based application data link will be main stream and more 4G or 5G based data link will be used for time-sensitive, large data flow, long distance applications using small-sized UAVs as platform.

## Hypothesis



Zhili Shao, Master student of System Engineering with Embedded System at HSN, Kongsberg. Shao.zhili@student.hbv.no