

E2.01: Light-Fidelity System (Li-Fi)

Electro-Magicians

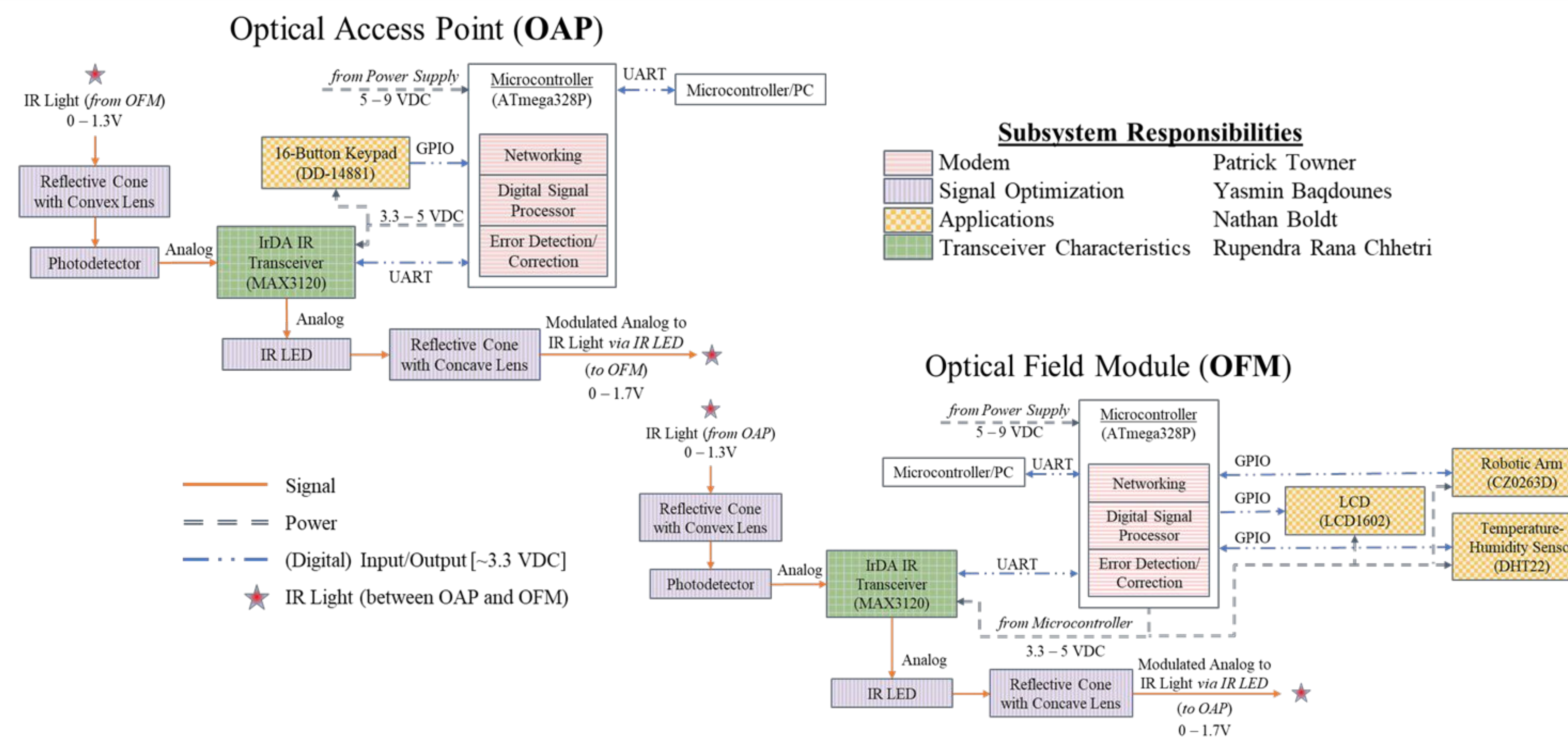
Patrick Towner (PM), Yasmin Baqdounes, Nathan Boldt, Rupendra Rana Chhetri



BACKGROUND

- Light-Fidelity Technology Proof-of-Concept
- Optical Wireless Communication
- Stream content from a server and the internet
- Viable alternative of Wi-Fi for future space missions
 - Existing overhead lighting can be upgraded with off-the-shelf parts for implementation
- Capacity and Speed
 - Allows over **82K** times more available frequencies than RF
 - Up to **15.73 Gbps** can be achieved over 1.6m
- Advantages
 - EMI has less impact on light than RF
 - Line-of-sight dependent

SYSTEM BLOCK DIAGRAM



MEET THE TEAM



Yasmin Patrick Rupendra Nathan

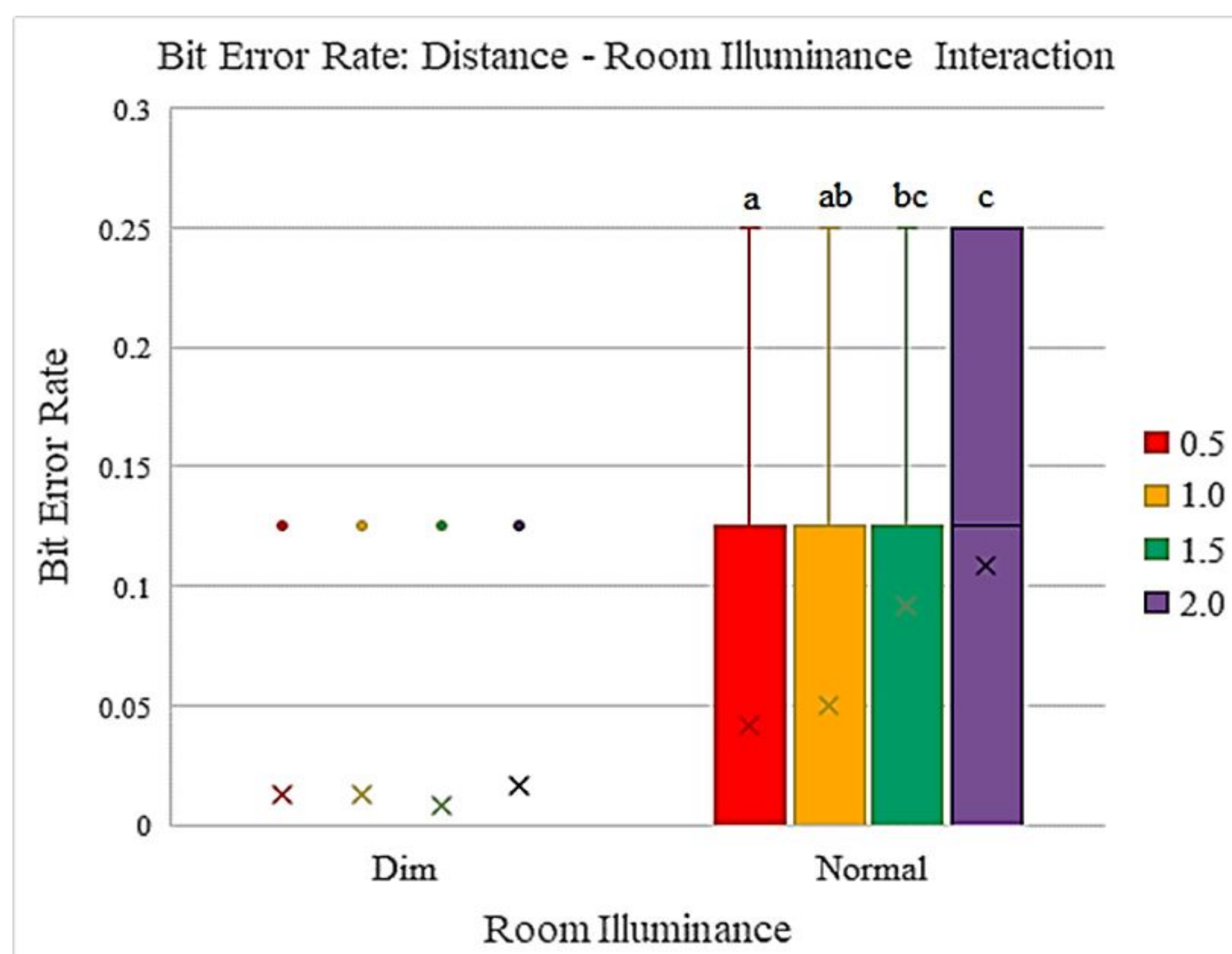
DESIGN CHALLENGES

- **Interference:** Crosstalk, external light, obstructions affect uplink/downlink signals
- **Coverage/Directionality:** Line-of-sight limitation, complex components required to extend network range
- **Mobility:** Horizontal (Li-Fi-to-Li-Fi), Vertical (Li-Fi-to-Wi-Fi) handover
- **Exposure:** Intense NIR light can penetrate eyes and skin, causing exposure risks

TEST DATA: APPLICATION

Application Speed Test	Trials	Average Bit Rate
Robot Arm	First 50 Trials	136.63 Bits/s
	Second 50 Trials	139.44 Bits/s
Temperature	First 50 Trials	145.3 Bits/s
	Second 50 Trials	135.79 Bits/s
LCD	First 50 Trials	137.84 Bits/s
	Second 50 Trials	146.54 Bits/s

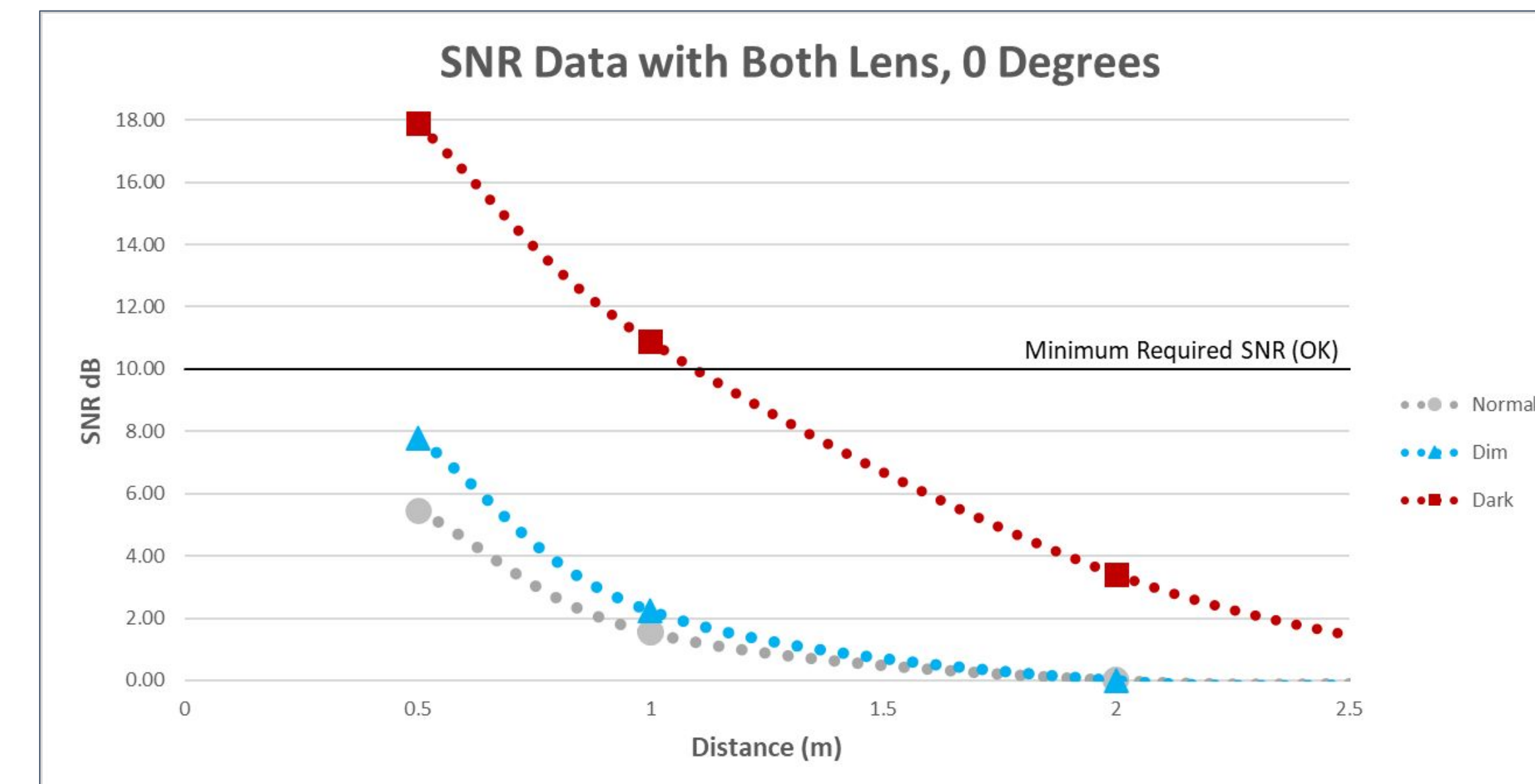
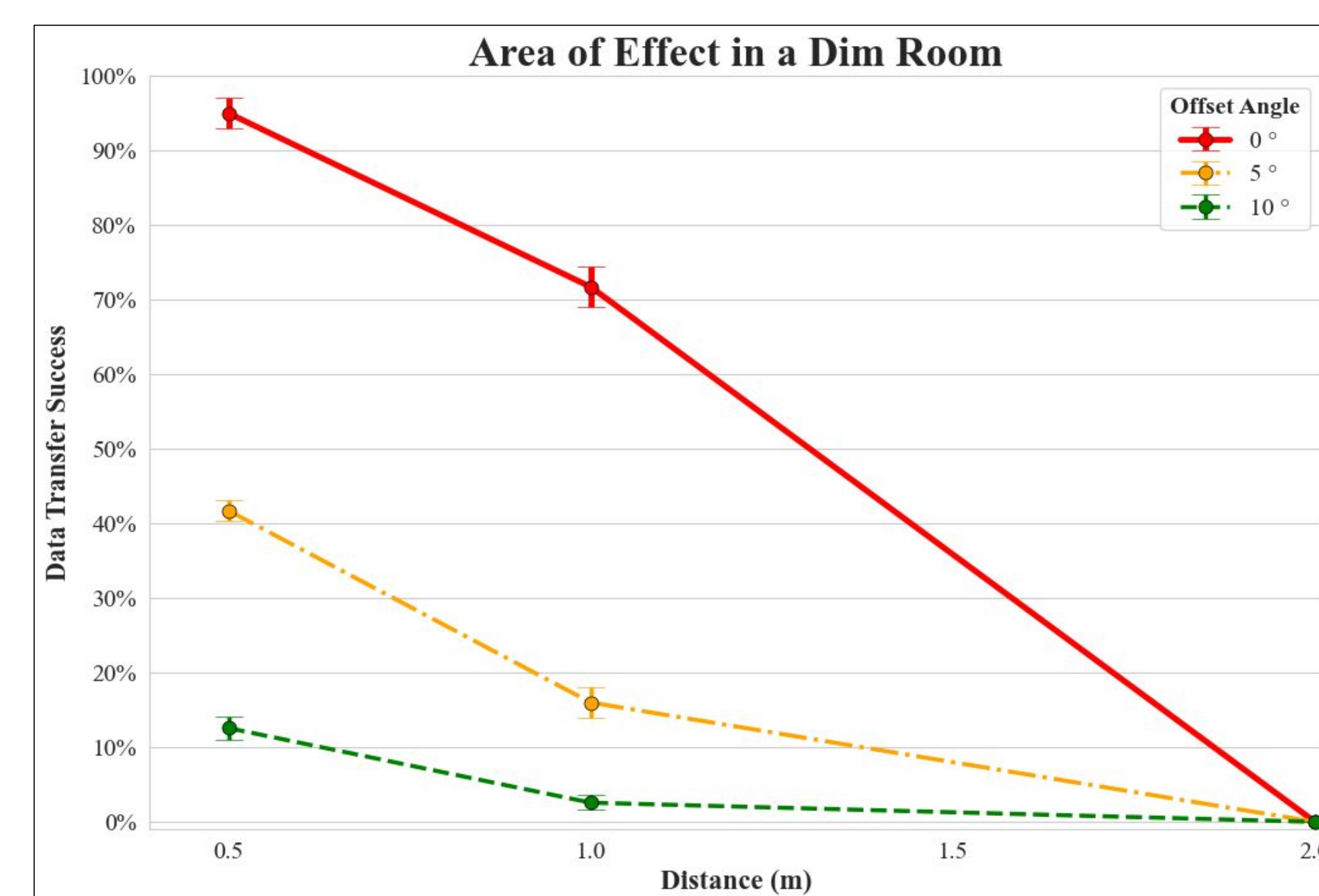
TEST DATA: MODEM



Distance (m)	Room Illuminance		F value	p value
	Dim	Normal		
0.5	0.013 ± 0.038	0.042 ± 0.076	3.94 _{3,230}	0.27
1.0	0.013 ± 0.038	0.050 ± 0.070		
1.5	0.008 ± 0.032 ^a	0.092 ± 0.073 ^b		
2.0	0.017 ± 0.043 ^a	0.108 ± 0.108 ^b		

This table shows how distance and room illuminance affect mean bit error rate (BER) for transmission, under dim and normal illuminance. ^{a, b} indicates significant differences in BER at a given distance across room illuminances.

TEST DATA: SIGNAL OPTIMIZATION



TEST DATA: TRANSRECEIVER CHARACTERISTICS

Test	Results
Transmitter (V)	1.3 V
Receiver (V)	0.53 V
Power (mW)	291 mW

ACKNOWLEDGEMENTS

NASA Sponsor: Mr. George Salazar
Principal Investigator: Dr. Richard Compeau
Faculty Advisor: Mr. Mark Welker

DESIGN CONCEPT

