



Airborne Sensors for the Defence Market

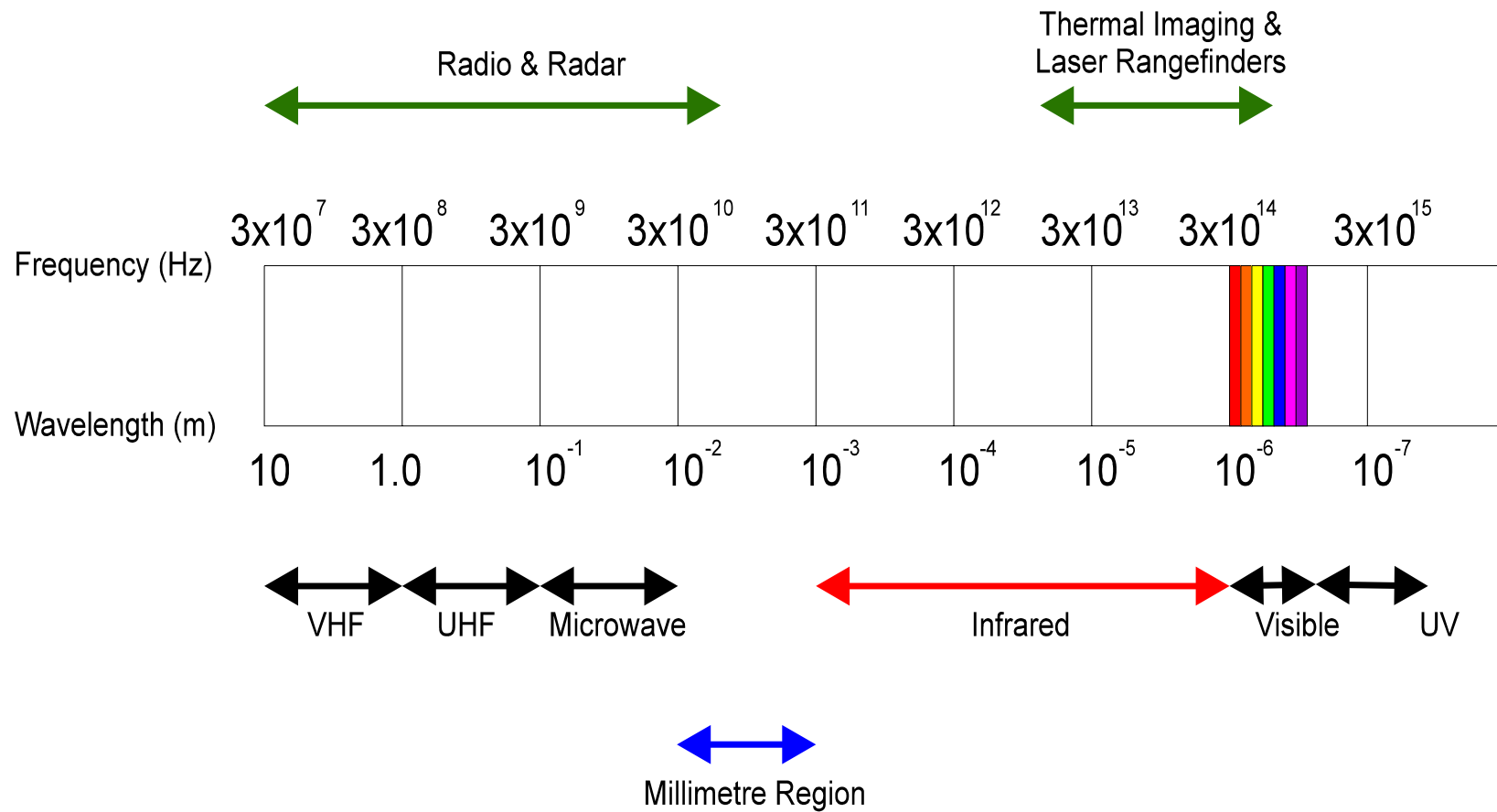
A Review

23 April 2008

**Dr Jim Jack, Advanced Projects Group,
SELEX, Edinburgh**

- **Introduction**
- **Background**
- **Technologies**
- **Detector Technology**
- **LIDAR**
- **Multi/Hyper-Spectral Imaging**
- **Brown-Out**

INTRODUCTION



THE FUTURE ???



- **Airborne Environment**
 - **Classify Objects of significant interest**
 - **Objects may be vehicles, people, clouds**
 - **Tasks:- Detect, Track, Recognise, Identify**
 - **Situational Awareness – Navigation, Landing Aids, Collision Avoidance, Attitude Control**
 - **Automation**

 - **Limitations - atmosphere, diffraction, digitisation, background noise, CC&D, Displays**
- **Air-to-Ground & Air-to-Air Attack**
- **Day/Night & All Weather**
- **Presentation to Human Decision Maker**

- **Spatial Resolution**
 - Diffraction Limit Driven by Aperture
- **Range Limitation**
 - Limited Stand-Off Range
- **Target Classification**
 - Poor Resolution, Poor Contrast
 - Uncertainty in Target Acceptance

- **Affordability**
- **COTS/Industrial Standard Equipment**
- **Upgrade Potential Through Product Life**
- **Increased Performance**
- **Multifunction Systems**
- **Increased Political Considerations**

- **Conventional Imaging is Outdated**
- **Sensors Become Photon Analysers**
- **Multi Sensor Data Fusion**
- **Interface to Human Observer**
- **Technology Supports Range of Applications**

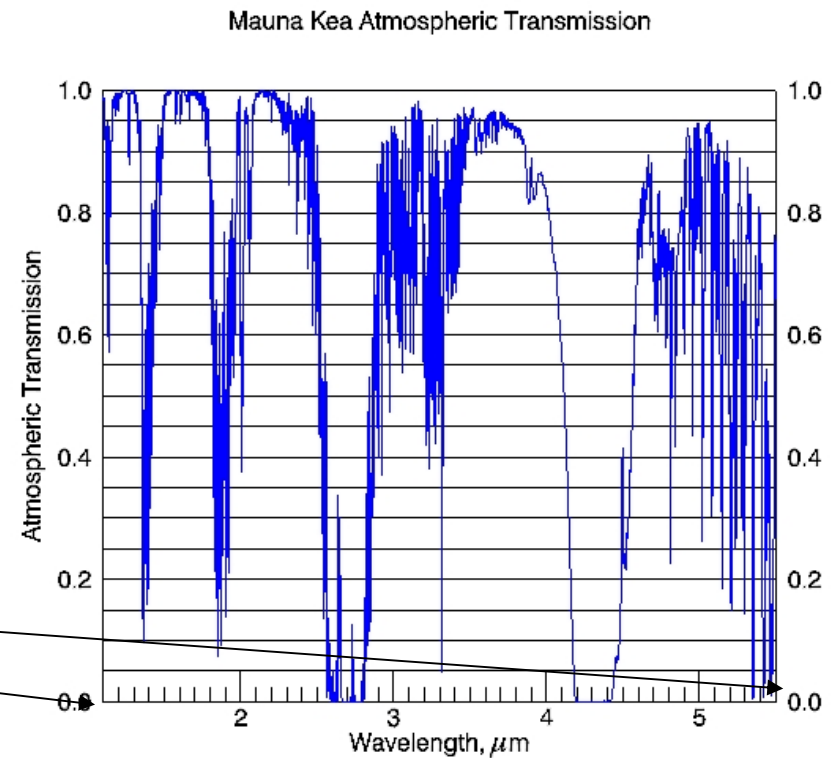
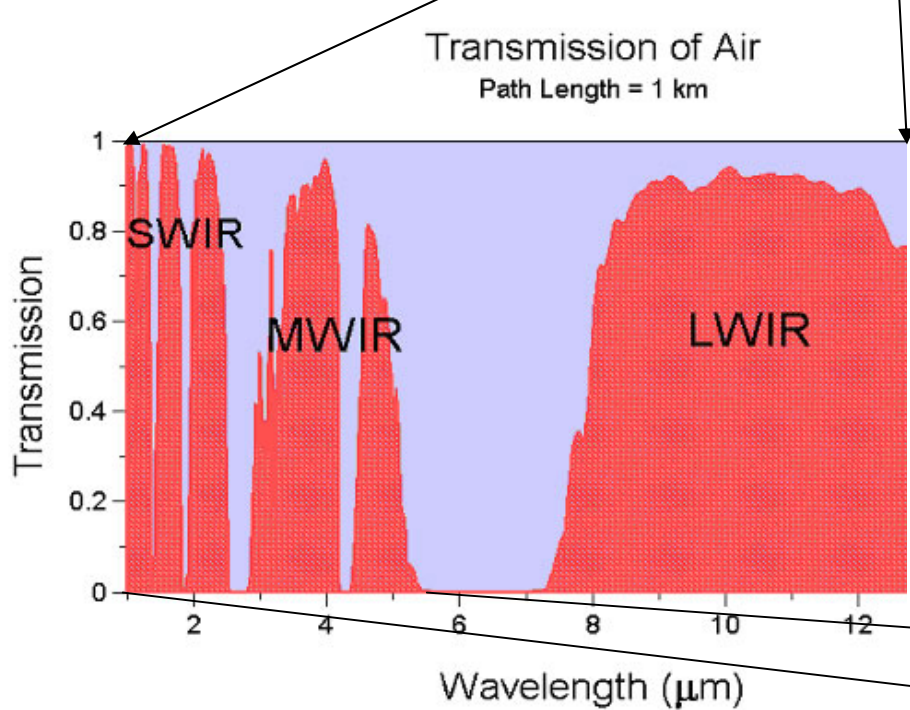
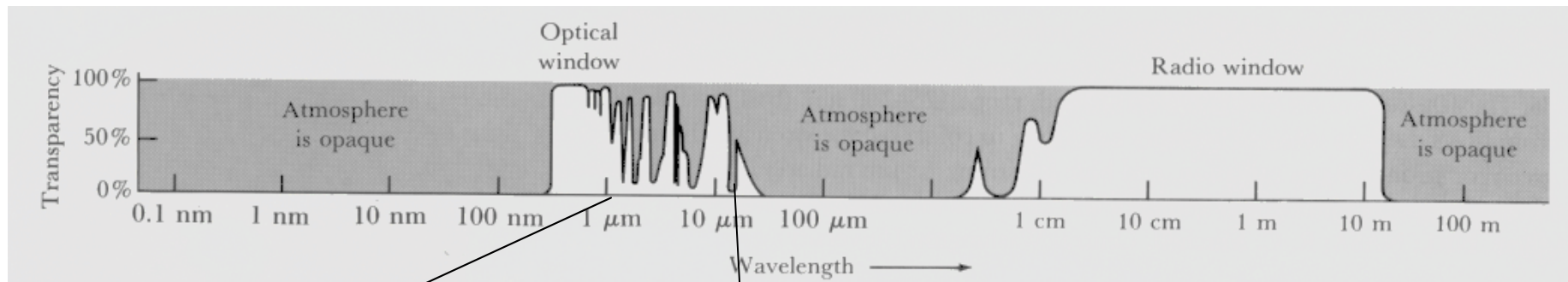
POSSIBLE TECHNOLOGY SOLUTIONS



- **Advanced Passive IR**
- **Active IR/Burst Illumination Lidar**
- **Hyper/Multi-spectral Imaging**
- **Vibrometry**
- **Polarimetry - Passive & Active**
- **Laser Ranging**
- **Laser Designation**
- **Laser Range Profiling**
- **Remote Spectroscopy**
- **Scanning LIDAR**
- **Millimetric Wave Imaging**

- **Imaging Sensors**
- **Several Well Defined Wavebands**
- **Intensity Based Response**
- **Spatial Resolution/Angular Resolution**
- **Target Contrast**
- **Aperture Limited**

Atmosphere

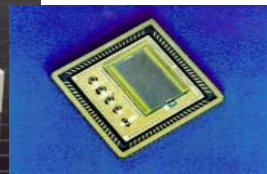
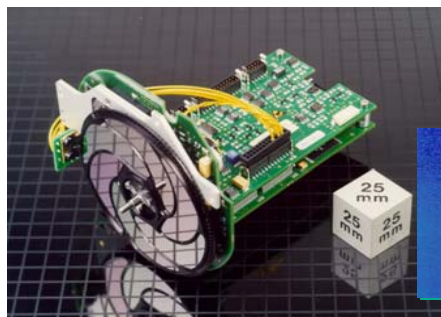
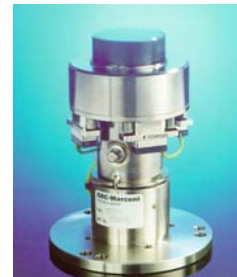
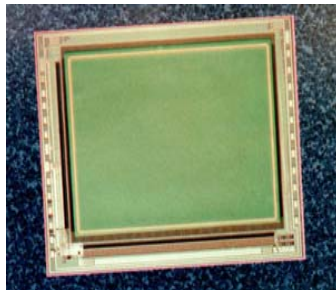


DISPLAYS - Head Up, Head Down & Head Mounted



DETECTOR TECHNOLOGY

Infrared Detectors - Southampton



Major Defence Programmes

TICM
Harrier
EFA IRST
Challenger
LION

Tornado
Felix
AV8B
TIALD

Products

- Focal plane arrays for Thermal Imaging:
 - Long Linear: - EFA IRST, STAIRS "C"
 - 2D - 3-5um CMT, 8-12um QWIP
 - 2D - Uncooled
- Missile fuse and guidance detectors
- Detectors for gas analysis & spectroscopy

Uncooled Long Wave IR



STAIRS C Imagery



Typical Current NAVFLIR image



LIDAR

Introduction/Background

Joint Anglo-French project mid 1990s.
Test-Bed for advanced LIDAR Systems.

Clara: MultiFunction Coherent LIDAR:
Obstacle warning, ranging, MTI,
Vibrometry, True Air Speed, Laser
Imaging

Laser Illuminators, Targeting Systems,
Countermeasures



LIDAR Objectives

- **Military Objective:**
 - UAV scans a pulsed laser source to generate a 'cloud of points',
 - Generate textured map for use by ground/air commanders.
- **Civilian Objective:**
 - Digitise laser returns to determine material properties (vegetation health etc.)

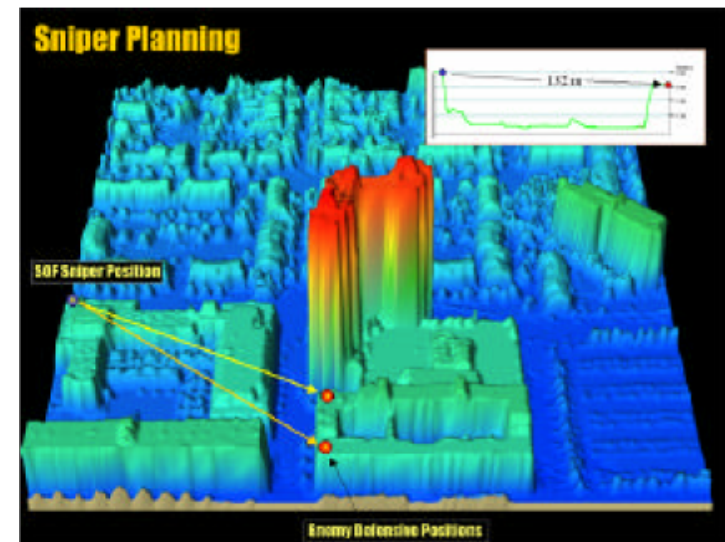
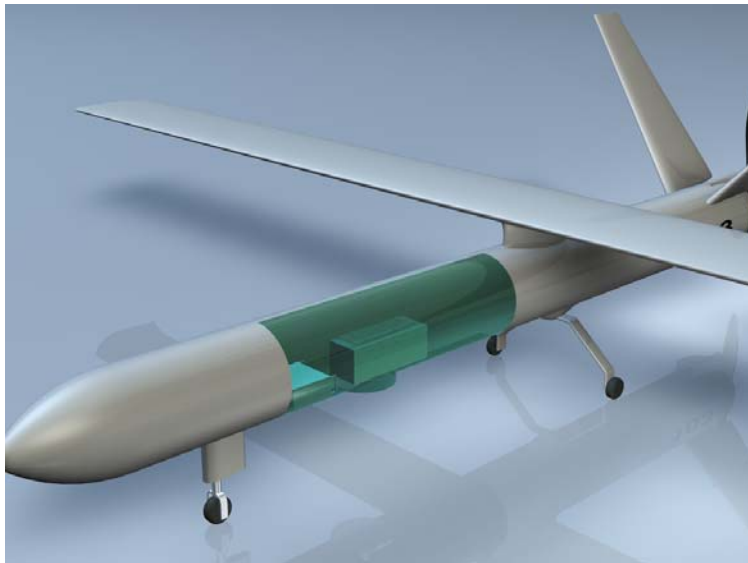
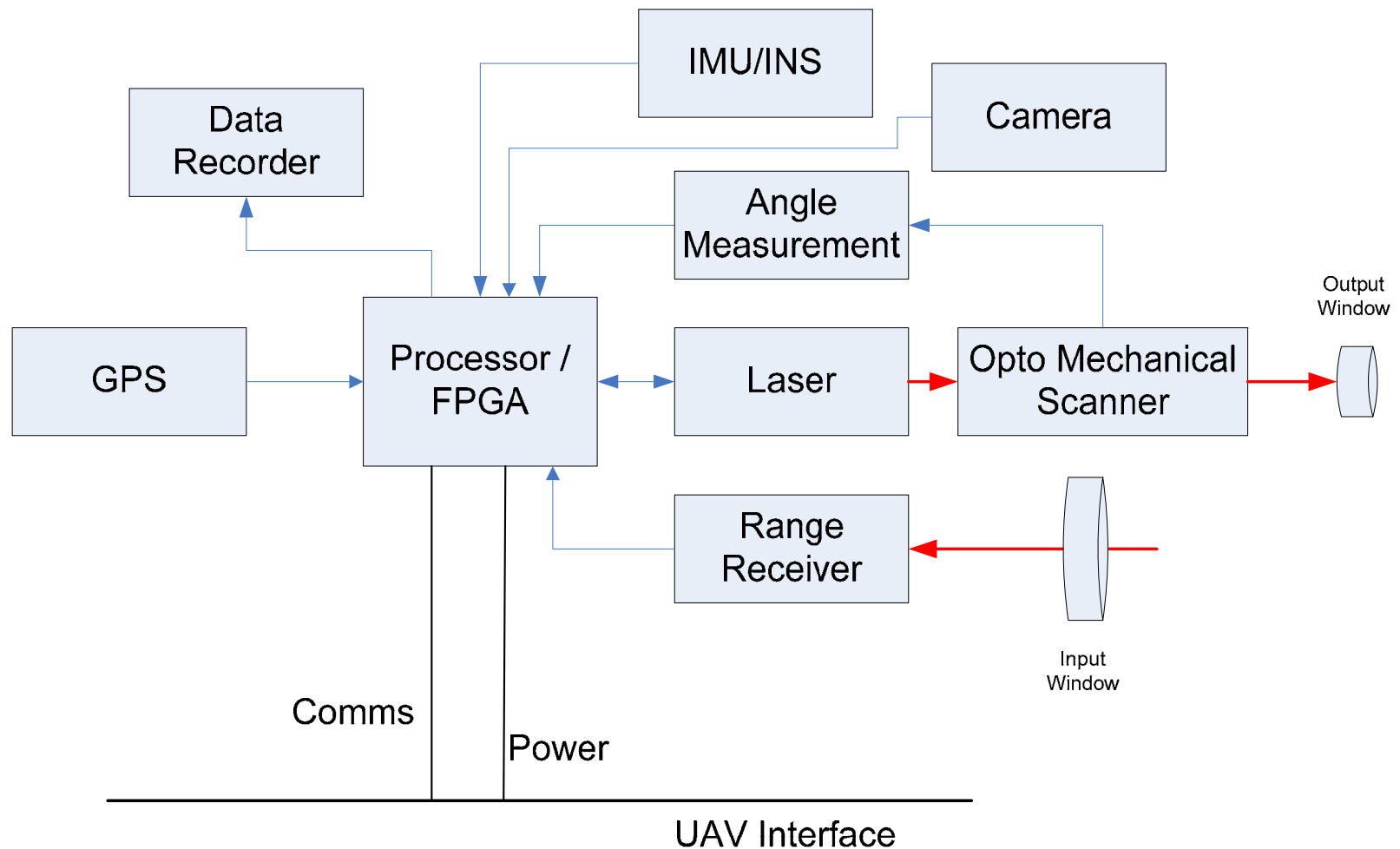


Figure 16: Sniper Planning Scenario

LIDAR Block Diagram



TYPICAL LIDAR SUPPLIER - Optech



LIDAR Company	Description
Optech Incorporated, 300 Interchange Way, Vaughan, Toronto, Ontario, Canada, L4K 5ZB Tel: 1-905-660-0808 Fax: 1-905-660-0829 www.optech.on.ca Point-of-contact: Albert Iavarone.	Based in Canada. Well established. Design, manufacture and supply LIDAR systems and provide LIDAR survey services.

Assessment showed the Optech Gemini to be too large to fit any of the TUAV airframes.

Solution: Design and Build Special LightWeight LIDAR



Typical LIDAR Image



Image Provided
by RiegI Ltd

Environmental LIDAR

- **Designed and Built LIDAR for University of Edinburgh**



MULTI/HYPER-SPECTRAL SENSING

HYPERSPECTRAL IMAGING

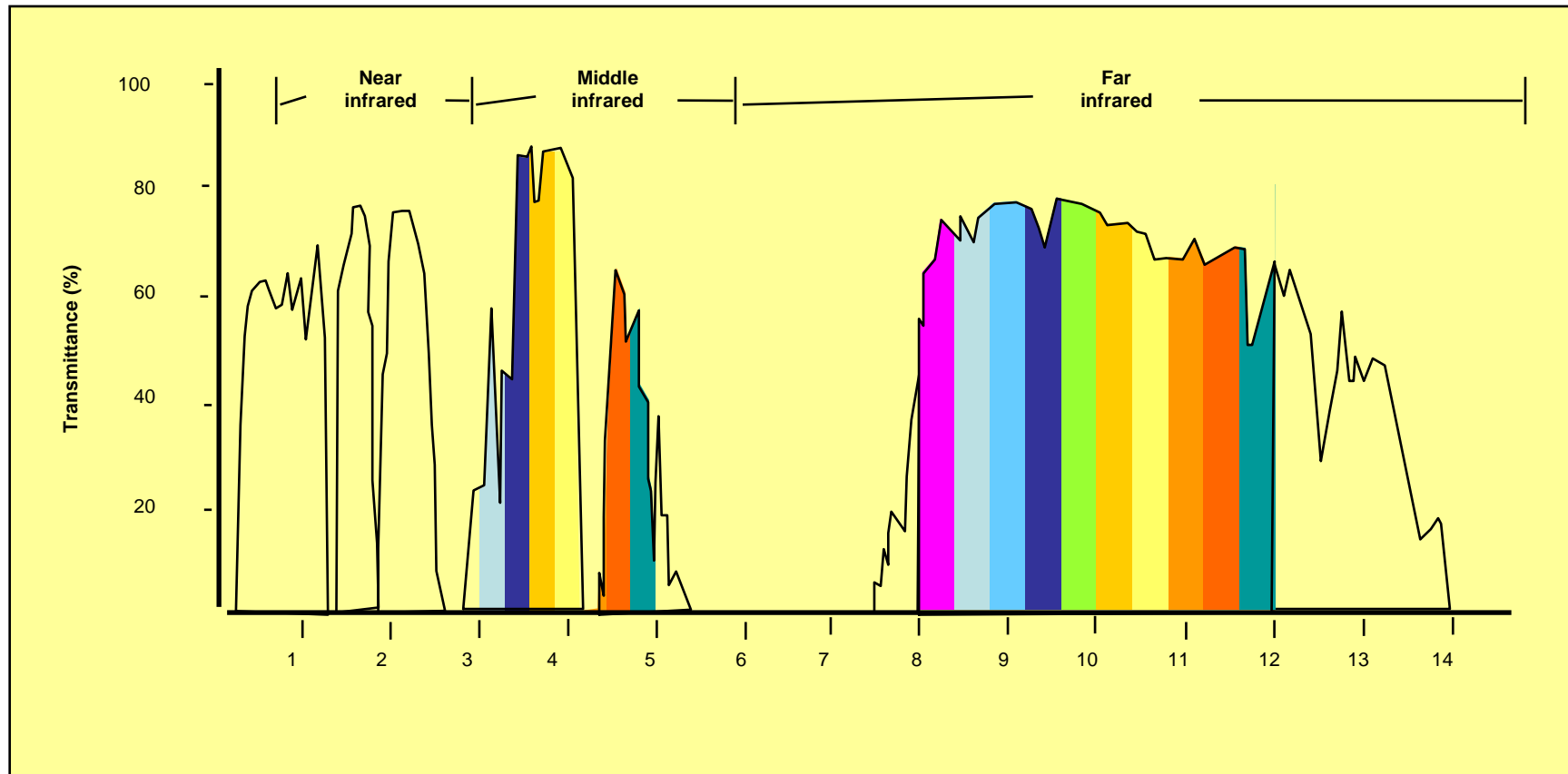
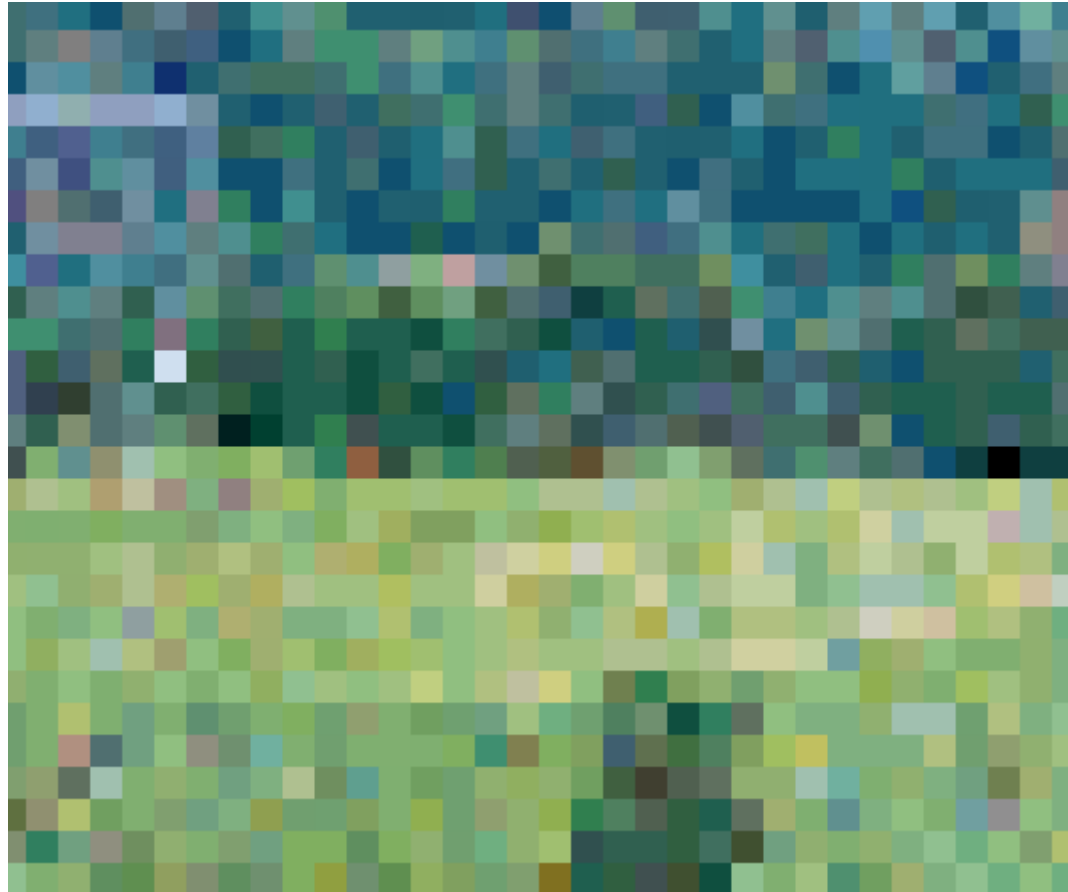
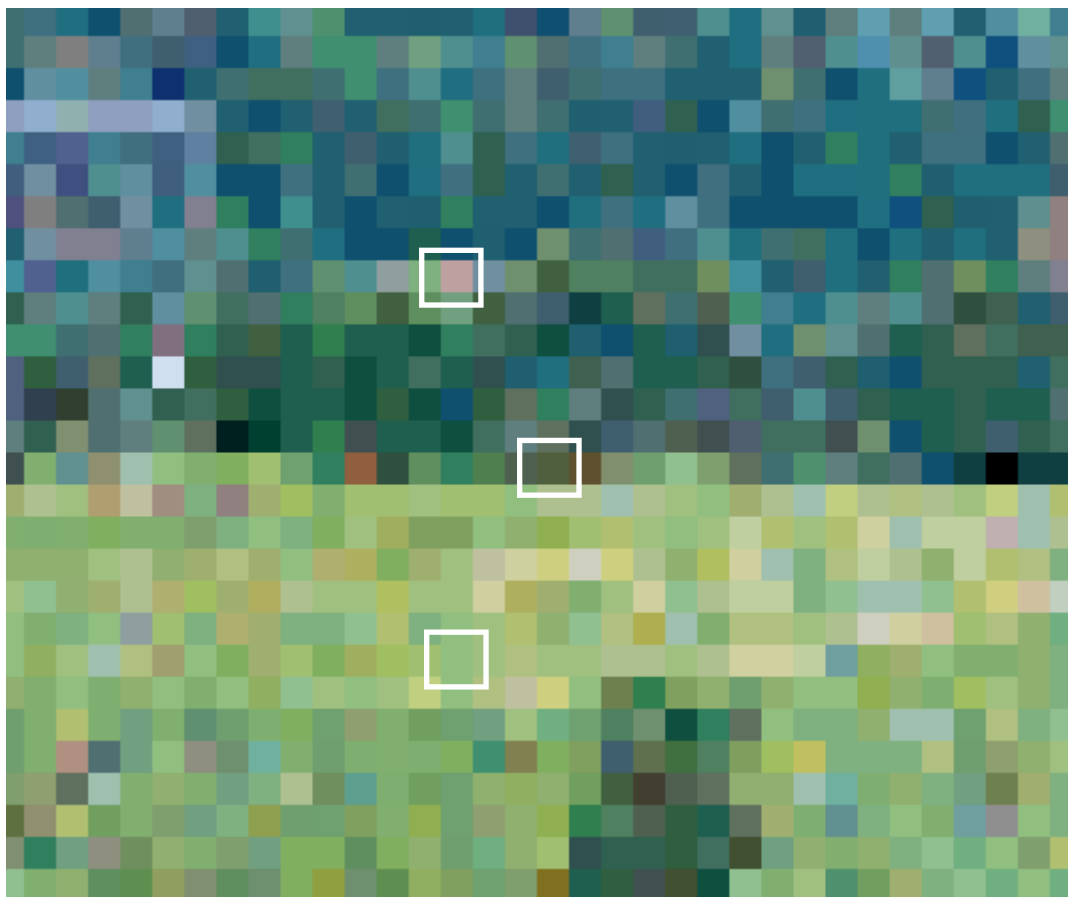


Image of the Typical Scene

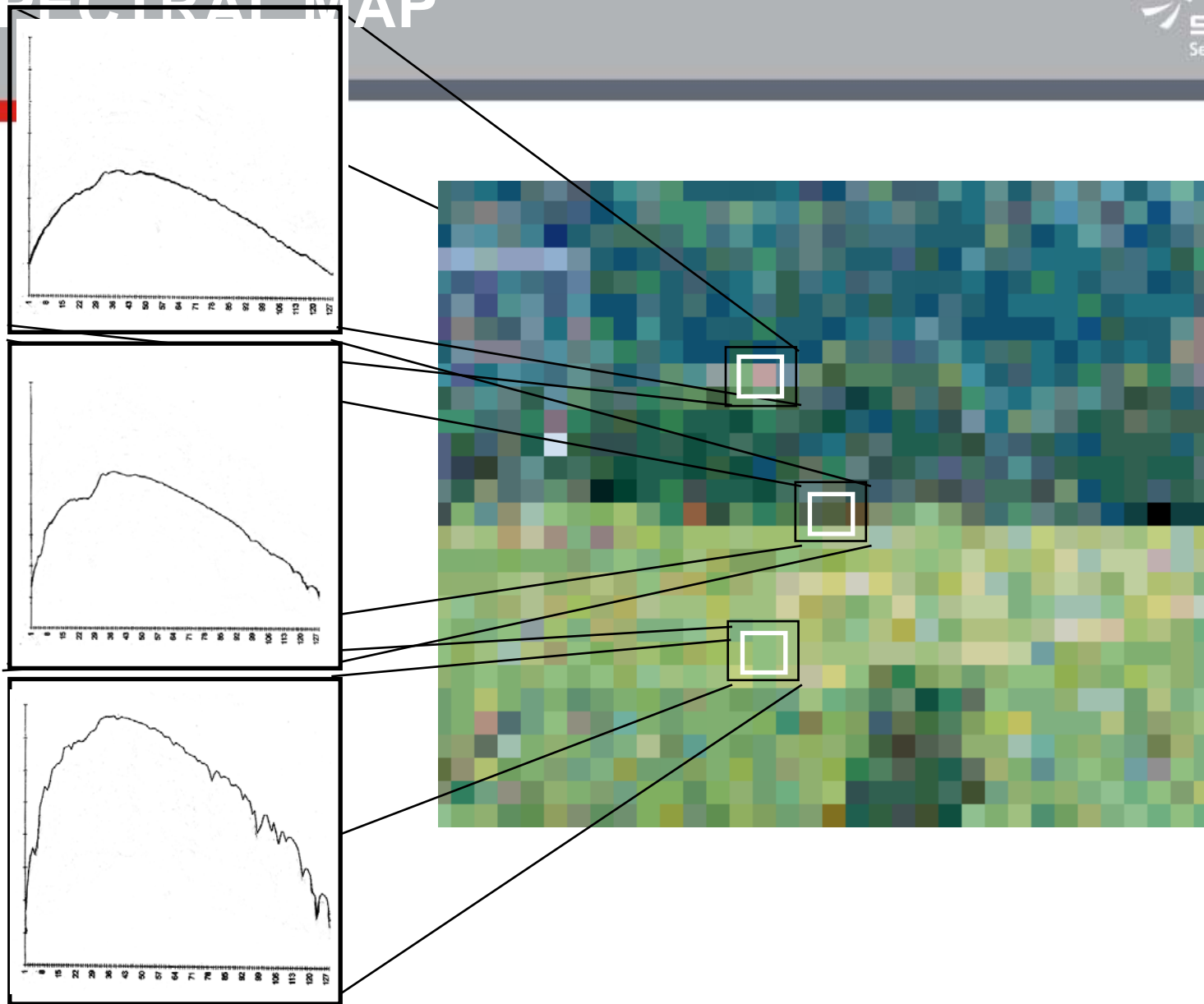


Pixelated Image of the Scene





SPECTRAL MAP



BROWN-OUT LANDING AID

LANDING PROBLEM



