Preliminary Thesis Outline

1. Introduction
    (a) Background
        i. 21-cm Basics
        ii. History of the Intergalactic Medium
            A. Cosmic Microwave Background and the Epoch of Recombination
            B. Dark Ages
            C. Cosmic Dawn
            D. Epoch of Reionization
            E. Galaxy Evolution (is there a formal name?)
        iii. Dark Energy and Cosmic Structure
        iv. Intensity Mapping
    (b) Experiments
        i. Global 21-cm Spectrum: SCI-HI
        ii. 21-cm Intensity Mapping: GBT
2. SCI-HI System Development
    (a) Antenna
        i. Design Considerations
        ii. Simulation
        iii. Scale Model Testing
        iv. Antenna Pattern and Impedence
        v. Construction
        vi. Portability and Travel
    (b) Electronics
        i. Calibration Switch
        ii. Amplifiers
        iii. Impedence and Efficiency
        iv. Filters and Attenuation
    (c) Data Processing (aka Computer)
        i. ADC (sampling, integration, etc)
        ii. Power (AC vs DC, Consumption and Heating)
        iii. Noise Generation

iv. Faraday Cage

3. Radio Frequency Interference (RFI) and Site Testing

   (a) Overview

   (b) Site Evaluations

      i. Pittsburgh
      ii. Zona del Silencio
      iii. Algonquin
      iv. Green Bank, West Virginia

   (c) Isla Guadalupe

      i. Site evaluation (aka summit vs fishing village)
      ii. Logistical Challenges
      iii. Weather Impacts (both to experiment and to expeditions)
      iv. Measurements

   (d) Potential Low RFI Sites

      i. Isla Socorro
      ii. Isla Clarion
      iii. South Africa (Marion and Gough Islands)

4. SCI-HI Data Processing

   (a) Pre-calibration Processing

      i. Integration and Sampling
      ii. RFI
         A. Ionospheric effects
         B. FM band
         C. AM band
         D. Time variability
         E. Local RFI (aka village generator, spark plugs for trucks, etc.)

   (b) Calibration

      i. Calibration Datasets
      ii. Impedence and Efficiency
      iii. Milky Way Galaxy (GSM) Modelling
      iv. Calibration Factor (K)
         A. Johnson Noise Calibration