An Analysis of Alternative Jet Fuel Supply for Manassas Regional Airport Project Proposal

February 18, 2013

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Overview

- Why Alternative Jet fuel?
- Background
- Problem Statement
- Technical Approach
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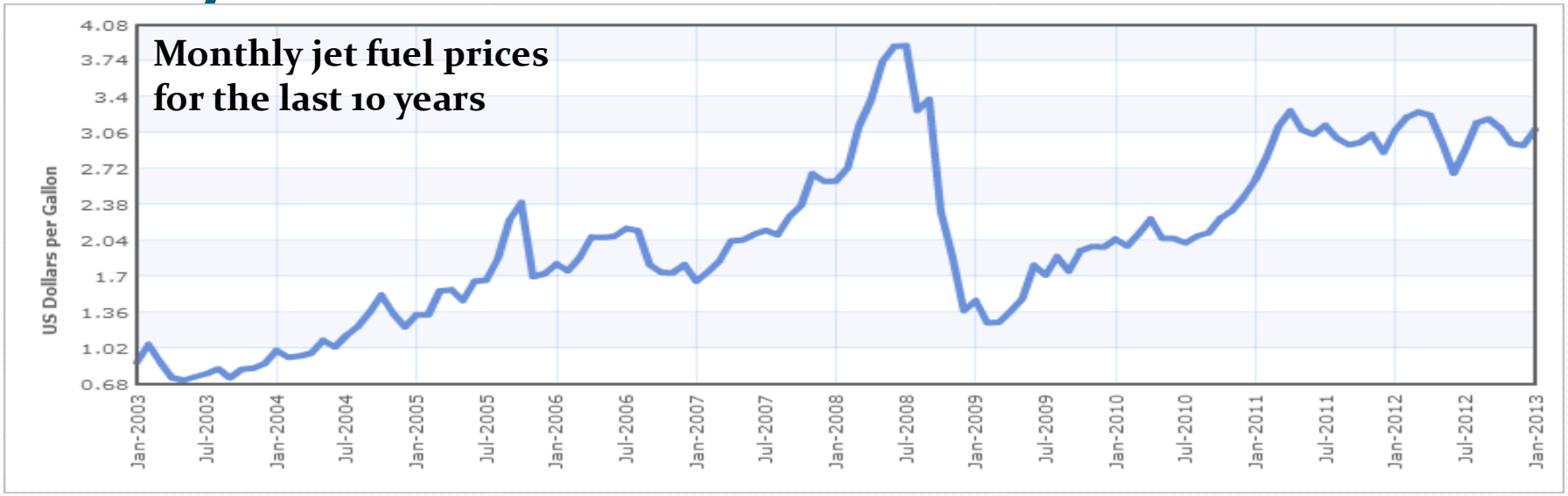
- Deliverables

Why Alternative Jet Fuel?

- The aviation industry is powered by petroleum
  - Limited supply on Earth
  - Volatile and steadily rising prices
- Aviation has limited alternatives for alternate sources of power

~~Batteries~~	Too heavy
~~Nuclear~~	Too dangerous
~~Solar~~	Not powerful enough
Biofuel	Too expensive? Maybe not

Why Alternative Jet Fuel?



- Jet fuel prices represent one of the biggest costs to the aviation industry
- Biofuels provide airlines with the opportunity to potentially reduce jet fuel prices along with their volatility by diversifying its supply and reducing the impact of carbon taxes.
- While diversifying and securing jet fuel supply, alternative jet fuel can also provide regional economic and environmental benefits

Drawbacks of Alternative Jet Fuel

- Many sources of biofuel are also sources of food
- Increased competition for these sources will increase price of biofuel and food
- Tilling new land for farming is a big source of greenhouse gas emissions

Background

- **Jet fuel**
  - Jet fuel is derived from kerosene, a safer alternative to gasoline
    - Gasoline can explode, kerosene just burns
  - Kerosene is a fuel oil made from distilling petroleum
  - “Synthetic” kerosene can be made from non-petroleum sources
- **Alternative Jet Fuels** (non petroleum-based jet fuels)
  - Sources include
    - Oils (algae, canola, soybeans)
    - Animal fats and greases
    - Biomass (energy crops, crop residue, wood chips)
    - Municipal solid waste
    - Non-petroleum Fossil fuels (natural gas, coal)

Background

Alternative Jet Fuel can be created using two methods:

Fischer-Tropsch (FT)

- A chemical process used to convert natural gas, coal, and biomass into liquid fuel
- Creates Fischer-Tropsch Synthetic Paraffinic Kerosene (FT-SPK), an alternative jet fuel that can be blended with conventional jet fuel to meet ATSM Specification D1655, the U.S. standard for commercial jet fuel.

Hydroprocessing

- A process of refining plant oils and animal fats into liquid fuels.
- Creates Hydroprocessed Esters and Fatty Acids (HEFA), also referred to as Hydroprocessed Renewable Jet (HRJ)

Background

Drop-in Fuel

- Alternative must be capable of replacing regular jet fuel without requiring new infrastructure.
  - Storage tanks and pipelines in the fuel supply chain
  - Fuel system that powers the engines on an aircraft.
- An alternative jet fuel capable of achieving this type of interoperability is known as a “drop-in” fuel.
  - Must meet the same chemical specifications as conventional jet fuel.
  - In the United States, the American Society for Testing and Materials (ATSM) has established these specifications for Jet A, which are described in ATSM Specification D1655.
- Why drop-in fuel?
  - Changes to existing aircraft fleets or fuel distribution networks would make alternative jet fuel practically infeasible

Conventional Jet Fuel Supply Chain

Petroleum feedstock extracted and refined

Conventional jet fuel production plant

Conventional jet fuel transportation

Conventional jet fuel storage at airport fuel farm

Conventional jet fuel consumers

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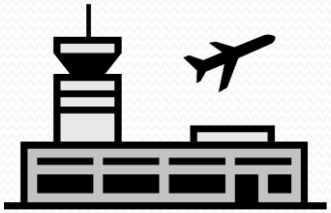
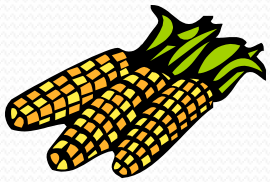
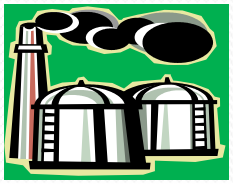


Conventional jet fuel consumers



Non-petroleum feedstock harvested and refined



Alternative jet fuel production plant

Alternative jet fuel transportation

Alternative and conventional jet fuel blending facility

Conventional jet fuel storage at airport fuel farm

Problem Statement

- **There are many challenges with introducing bio-based alternative jet fuel. They include:**
  - Feedstock availability
    - Proximity to airport
    - Competition for supply
  - Economics
    - Supply chain logistics
    - Cost volatility
  - Regulatory limitations
    - Safety
    - Environmental impact

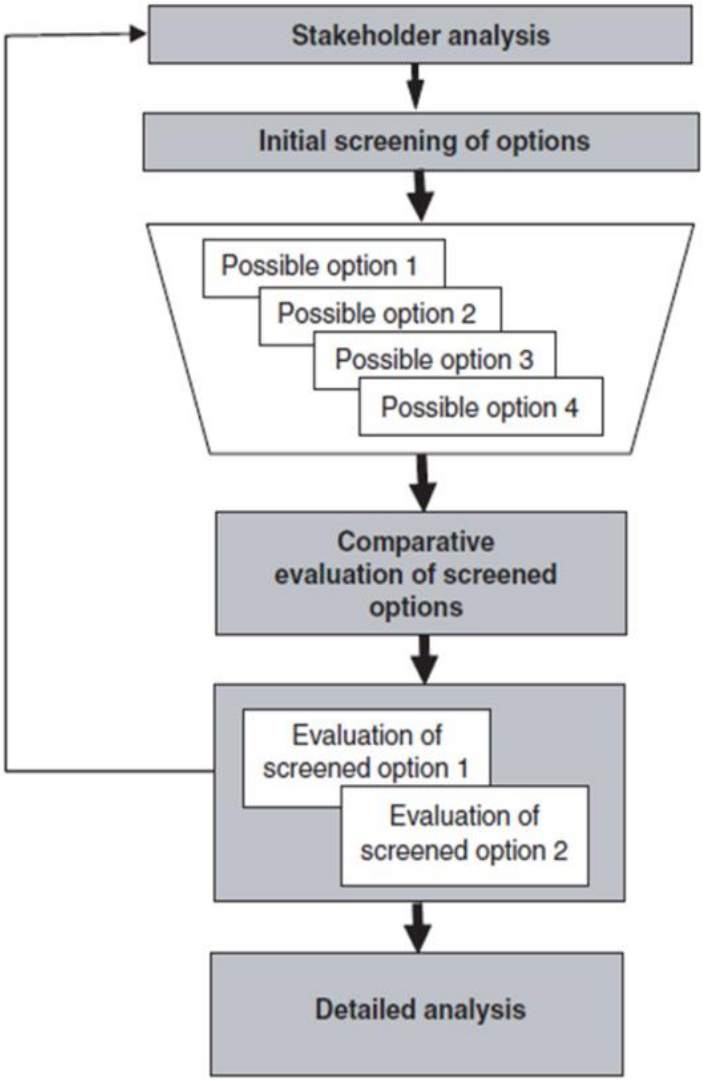
- **Customer Need**
  - Metron Aviation and CATSR/GMU want to know the best way to bring bio-based alternative jet fuel to Virginia airports.
  - Manassas Municipal Airport (KHEF), a regional airport in Northern Virginia, is interested in learning about the logistical and economic implications with integrating alternative jet fuel into its fuel supply chain.

Problem Scope

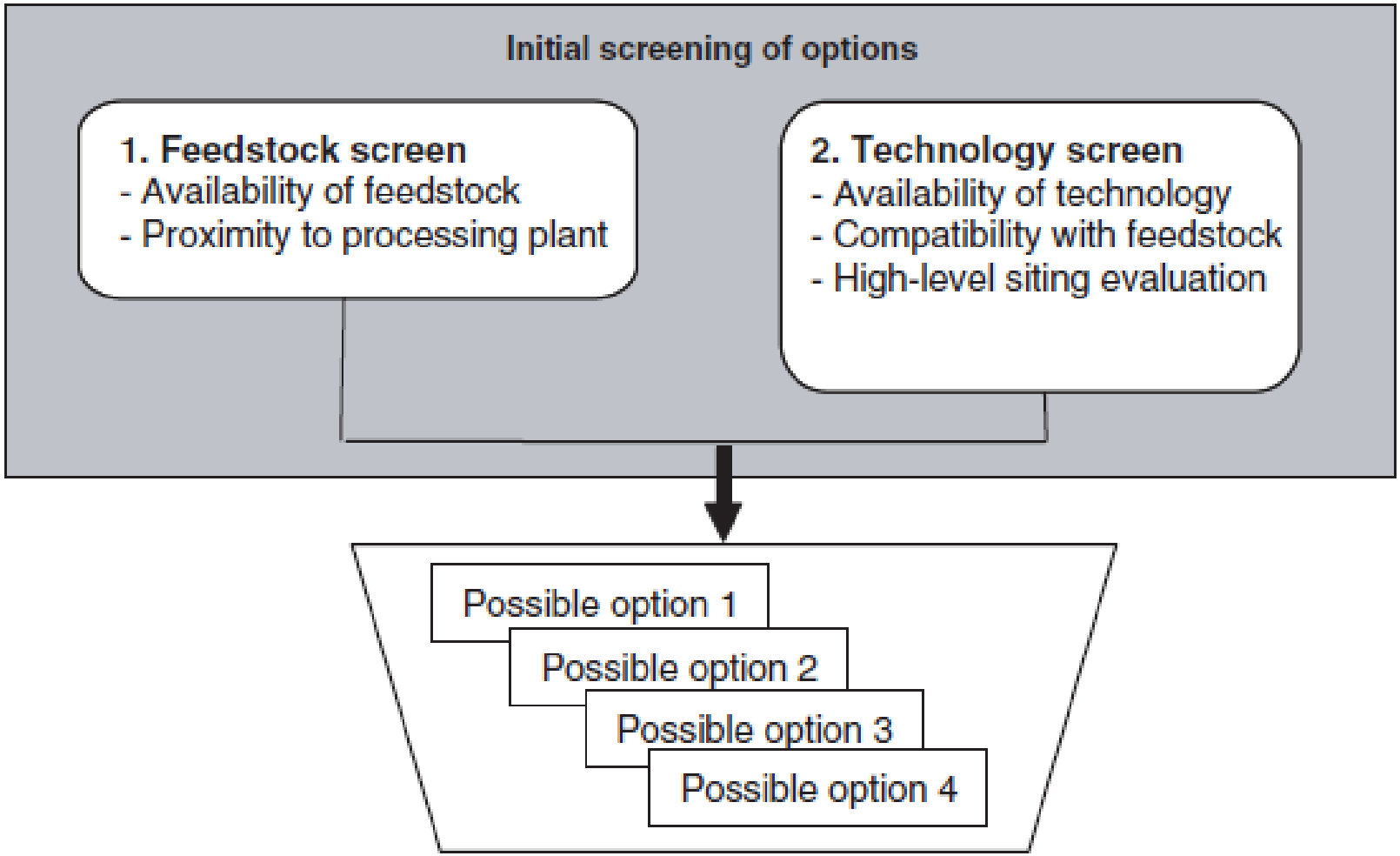
- In 2012, the Airport Cooperative Research Program (ACRP), a collaborative aviation research initiative focused on improving airport competitiveness with innovative solutions, published a report titled, *ACRP 60: Guidelines for Integrating Alternative Jet Fuel into the Airport Setting*.
- This report outlines a framework for evaluating the feasibility of introducing alternative jet fuels into an airport's jet fuel supply chain.
- Metron Aviation, who co-authored *ACRP 60*, is interested in validating the report's evaluation framework
- The GMU team will use KHEF as a test case for the *ACRP 60* framework

Technical Approach

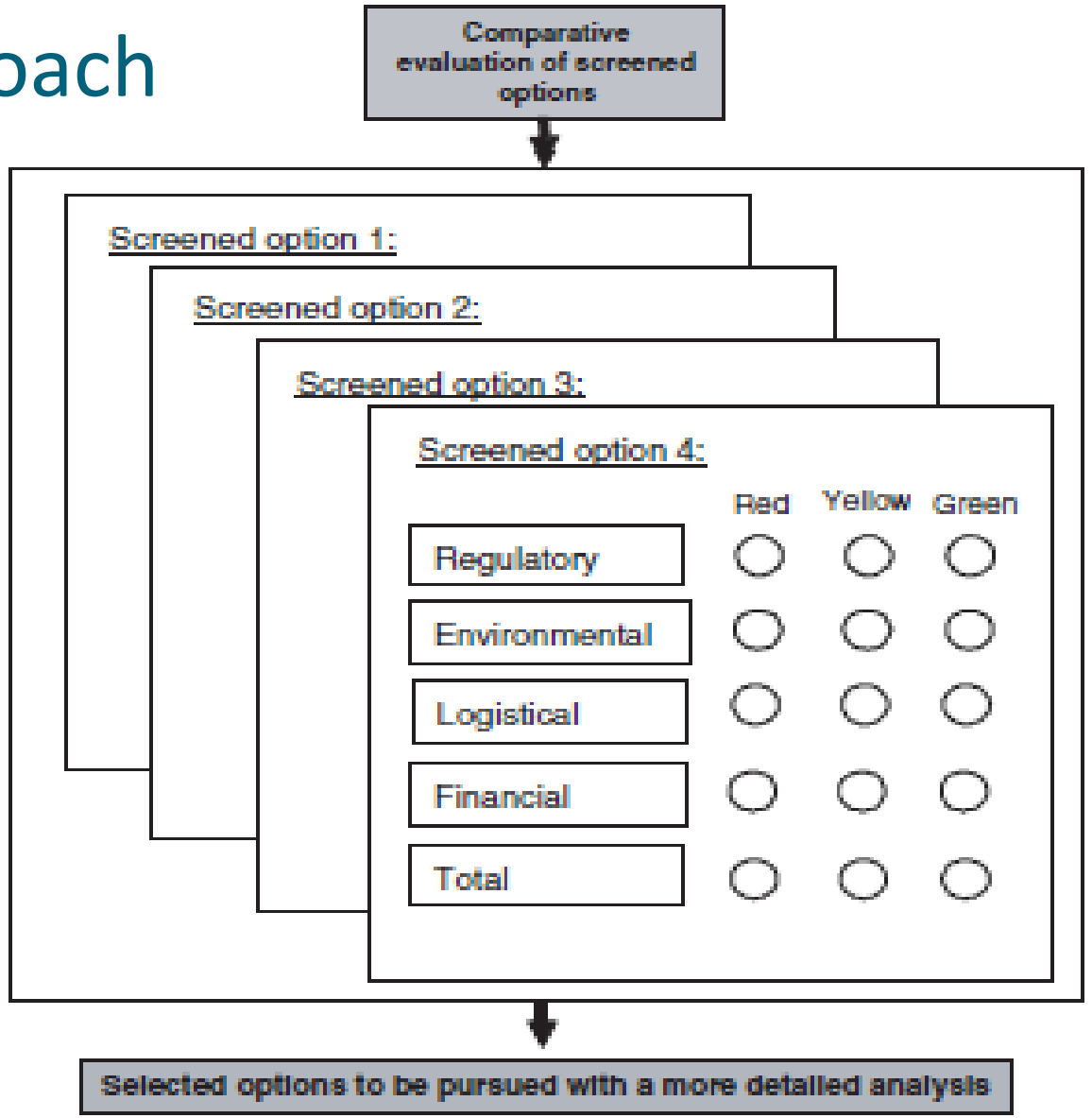
- Stakeholder Analysis
- Initial Screening of options
  - Considering needs of each stakeholder
- Comparative analysis of screened options
  - Select best for further analysis
- Detailed analysis of selected options
  - Logistical model
  - Economic Model



Technical Approach



Technical Approach

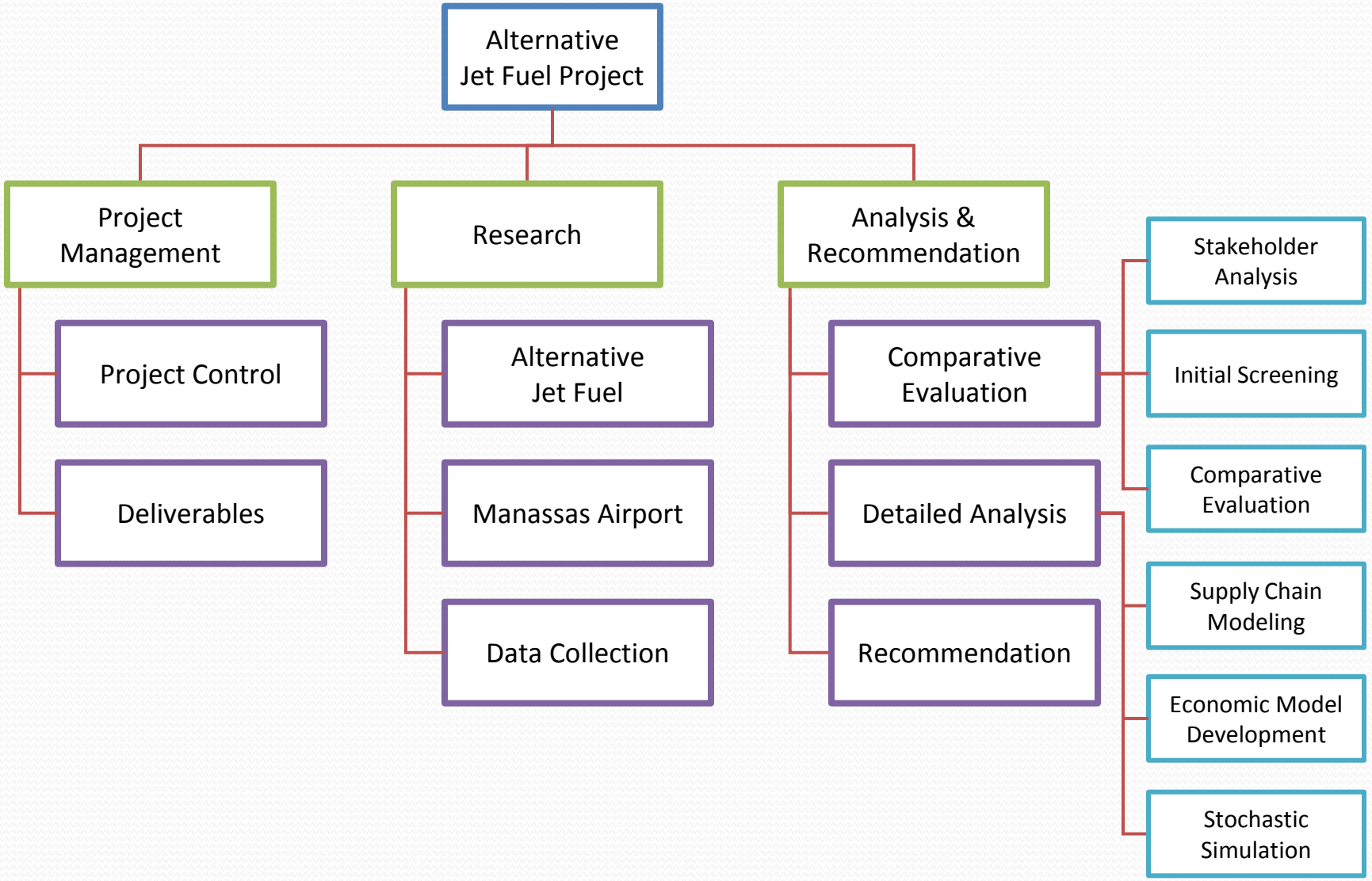


Detailed Analysis

- **Examine possible biofuel suppliers and determine feasible supply chain.**
  - Fixed costs and constraints
  - Environmental considerations (Regulations)
  - Transportation infrastructure
  - Facilities (Storage Facility and Blending Facility)

- **Evaluating the return of investment**
  - Stochastic model or simulation model taking into consideration forecasted demand along with fixed and variables costs.

Work Breakdown Structure



Schedule

	Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10	Week11	Week12	Week13	Week14	Week15
Alternative Jet Fuel Project	Feb.3	Feb.10	Feb.17	Feb.24	Mar.3	Mar.10	Mar.17	Mar.24	Mar.31	Apr.7	Apr.14	Apr.21	Apr.28	May.5	May.10
1. Project Management															
1.1 Project Control															
1.1.1 Meetings (Team, Sponsors & Stakeholders)	√	√ / √	√ / √	√	√ / √	√	√ / √	√	√	√	√ / √	√	√	√ / √	√
1.1.2 Allocate Tasks	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
1.2 Deliverables															
1.2.1 Proposal															
1.2.2 Status Report															
1.2.3 In Progress Review Presentation/Website															
1.2.4 Final Report															
1.2.5 Final Presentation															
2. Research															
2.1 Alternative Jet Fuel															
2.1.1 Background															
2.1.2 Possible Alternative Jet Fuel & Technology															
2.1.3 Alternative Jet Fuel Suppliers															
2.2 Manassas Airport															
2.2.1 Background															
2.2.2 Jet Fuel Supply Chain															
2.2.3 Traffic & Fuel Consumption															
2.3 Data Collection															
3. Analysis & Recommendation															
3.1 Comparative Evaluation															
3.1.1 Stakeholder Analysis															
3.1.2 Initial Screening															
3.1.3 Comparative Evaluation															
3.2 Detailed Analysis															
3.2.1 Supply Chain Modeling															
3.2.2 Economic Model Development															
3.2.3 Stochastic Simulation															
3.3 Recommendation															

Deliverables

- Final report will include:
  - Complete assessment of alternative jet fuel options for KHEF using the ACRP 60 method
    - Will include recommendations and lessons learned using the ACRP 60 approach
  - Model of logistics and technical feasibility of drop-in bio jet fuels at KHEF (how would it work, what new infrastructure/procedure is required).
  - Model of economic feasibility. Will include:
    - Model of demand/supply will be developed and used to determine feasibility in presence of increasing fossil fuel prices
    - Breakeven for infrastructure costs.

Literature Review

- Airport Cooperative Research Program (ACRP, http://www.trb.org/ACRP/ACRP.aspx), which supports a portfolio of projects on alternative fuels.
- The Commercial Aviation Alternative Fuels Initiative (CAAFI, www.caafi.org), a coalition of U.S. government agencies, manufacturers, airlines, and airport organizations.
- The Sustainable Aviation Fuel Users Group (SAFUG, www.safug.org), a coalition of airlines, manufacturers, and other organizations involved with alternative jet fuel.
- Federal Aviation Administration (FAA, www.faa.gov), aviation oversight authority in the United States

Questions?