An Analysis of Alternative Jet Fuel Supply for Manassas Regional Airport

In Progress Review

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Overview

- Project Objective
- Stakeholder Feedback
- Review of Alternative Jet Fuel Supply Chain
- Options Under Consideration

Project Objective

- Recommend a method for integrating bio-based alternative jet fuel into the jet fuel supply chain for Manassas Regional Airport
  - Determine available options for integrating alternative jet fuel into the supply chain
  - For each alternative jet fuel integration option, analyze cost and logistics
    - Cost – Capital investment, operating costs, breakeven costs and return on investment as compared with cost projections of a “do-nothing” case
    - Logistics – Feedstock availability and compliance to FAA and environmental regulations
- Scope - options evaluated from the perspective of APP Jet Center, an airport fuel distributor that stands to make money on the business venture as petroleum prices increase

Project Stakeholder Involvement

- Held meetings with all stakeholders
  - GMU CATSR – Project Sponsor
    - Validated project assumptions and assisted in re-scoping effort
  - Metron Aviation
    - Provided background information and guidance on estimating costs of bio fuel processing and considerations for logistical concerns
  - Manassas Airport Officials
    - Provided historical monthly fuel use information, fuel farm information and guidance on supply chain
  - APP Jet Center – Fixed Base Operator (FBO) at Manassas
    - Provided fuel pricing information and explained fuel storage and distribution process

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

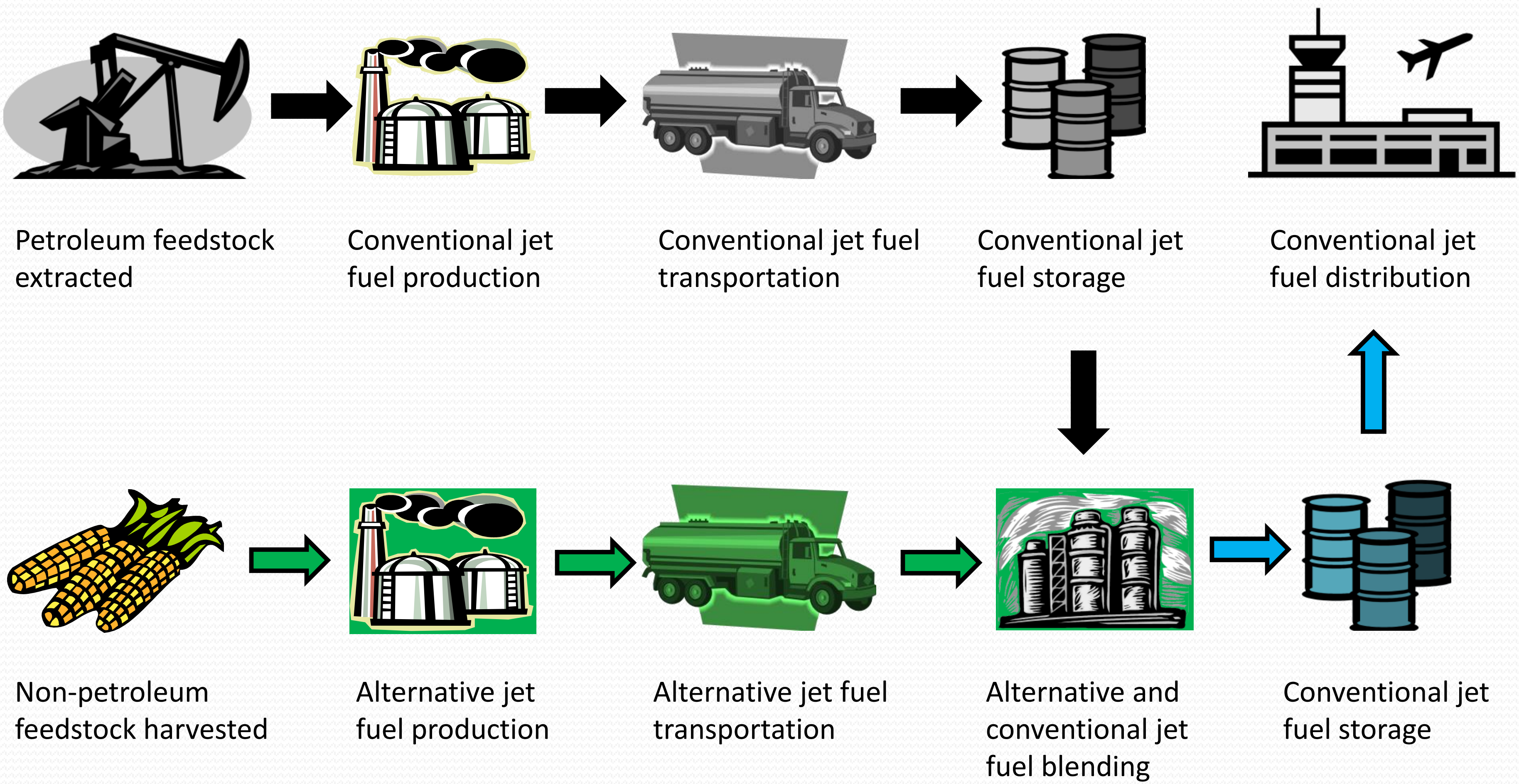
Conventional jet fuel production

Conventional jet fuel transportation

Conventional jet fuel storage

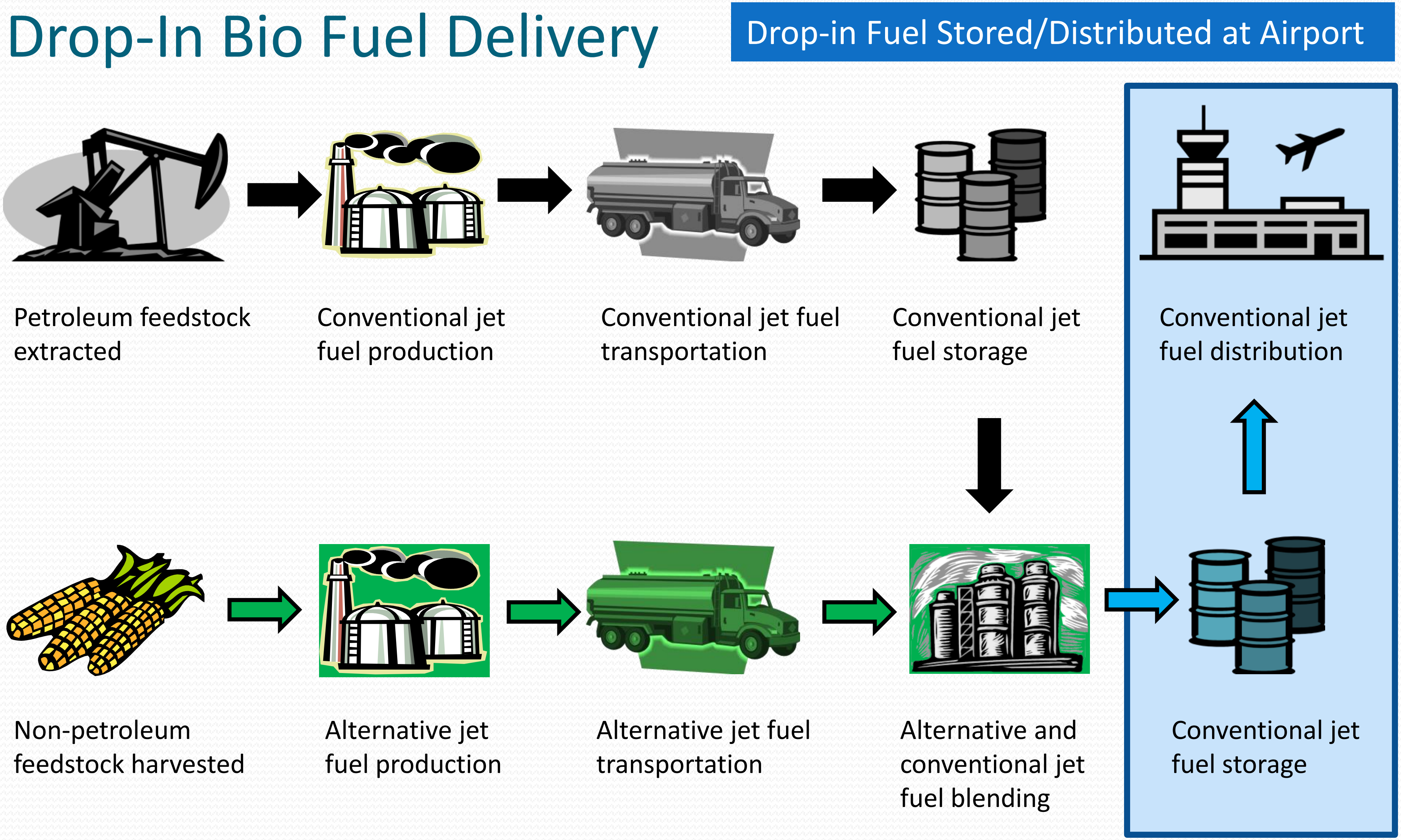
Conventional jet fuel distribution

Alternative Jet Fuel Supply Chain



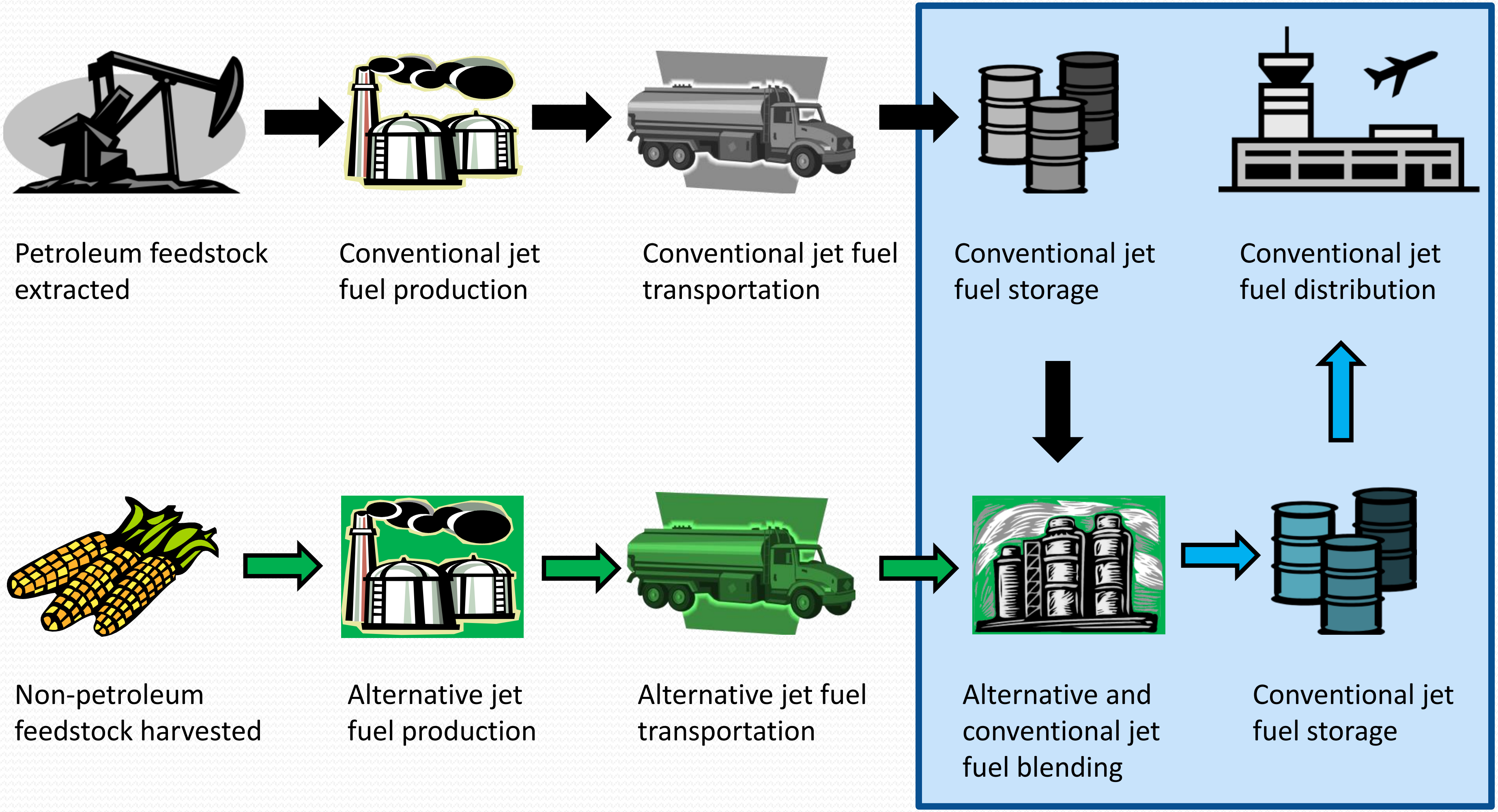
Option 1

Drop-In Bio Fuel Delivery



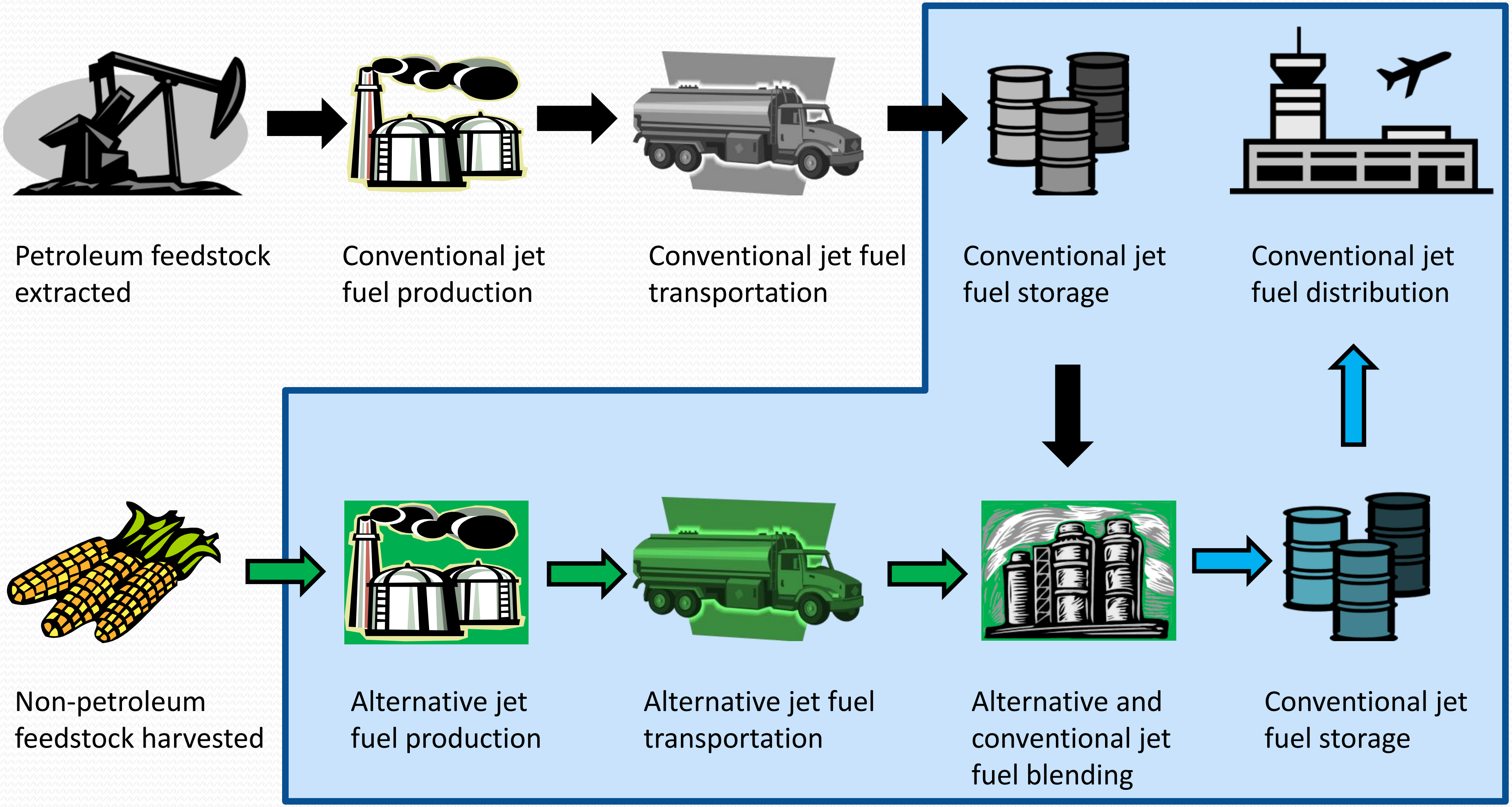
Option 2
On-site Bio Fuel Blending

Bio Fuel Blendeded at Airport
Drop-in Fuel Stored/Distributed at Airport



Option 3
On-site Bio Fuel Processing

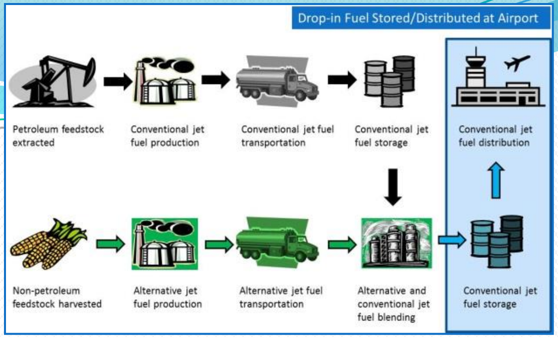
Bio Feedstock Refined at Airport
Bio Fuel Blendeded at Airport
Drop-in Fuel Stored/Distributed at Airport



Evaluating the Options

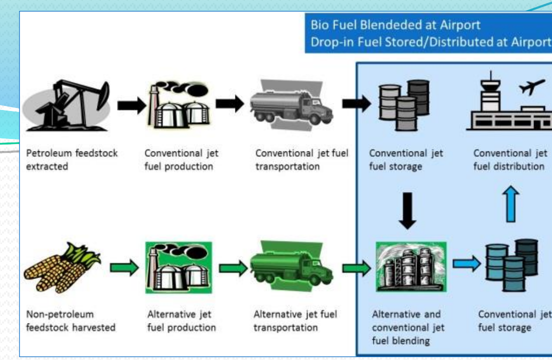
- For each option we will compare the total costs incurred for the years simulated.
- The base case model (APP continues to purchase, store, and distribute conventional jet fuel) and the option with the minimal costs will be compared to see if the yearly costs of distributing drop in biofuel will ever be equal or less expensive than the yearly costs of APP's current inventory policy.
- Assuming that demand does not change due to changes in fuel prices we will estimate when breaking even occurs for the processing facility.
- If possible we will run a regression model on the airport's fuel demand vs fuel prices.

Option 1

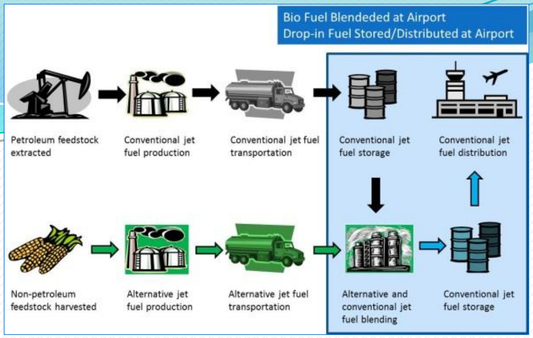


- Purchase drop-in biofuel directly from fuel supplier
  - Preferable fuel derived from hydroprocessed renewable oils for predictable performance characteristics and easy comparison to other options
- Jet A Cost_{ik} = J + F + FET + EXT + VA Motor .
- Drop in Biofuel Cost_{ik} = DB + Fixed Transportation Costs
- Total Cost_{ik} = 8,000* Jet A Cost_{ik} + 8,000*Biofuel Cost_{ik}
- Yearly Cost_{k} = Total Cost_{1k} + Total Cost_{2k} + …+ Total Cost_{12k}
  - DB = Per gallon cost of drop in biofuel. Random variable in which future costs will be forecasted.
  - Fixed costs = Per gallon fixed transportation costs of ordering the biofuel.
  - Drop In Biofuel Cost_{ik} = Per gallon costs of ordering drop in biofuel in month i of year k.
  - J = Eastern Aviation's per gallon price on Jet A fuel on month i of year k. This will be random variable.
  - F = Eastern Aviation's fixed freight rate cost per gallon of Jet A
  - FET = A fixed Federal Excise Tax per gallon of Jet A
  - EXT = A fixed Extended term and dealer link fee per gallon of Jet A.
  - VA Motor = A fixed Virginal Motor Fuel Tax per gallon of Jet A.

Option 2



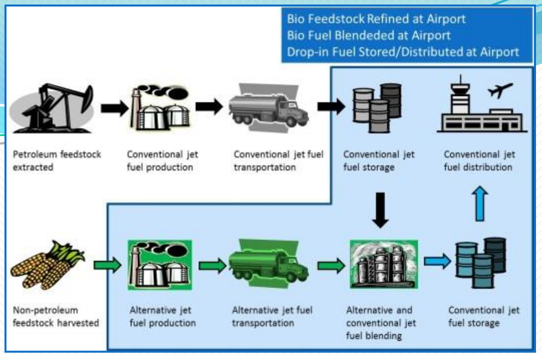
- “Splash Blending” is the cheapest method for blending alternative jet fuel with conventional jet fuel
- APP has two 20,000 gallon JET-A Fuel tanks.
- Siting for blending facility:
  - Within existing Fuel Farm
  - Reuse one of APP’s two existing fuel tanks for the splash blending



Option 2 – Analysis Approach

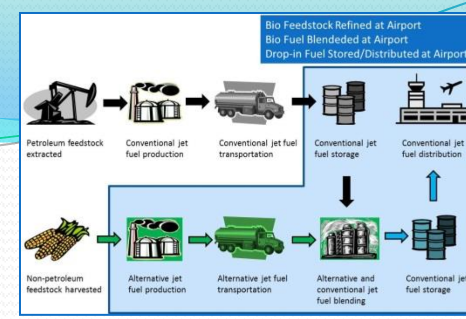
- Cost Model
  - Let X = amount of Jet A fuel ordered to be blended with the biofuel inventory to create drop in biofuel.
  - Jet A Cost_{ik} = J + F + FET + EXT + VA Motor .
  - Biofuel Cost_{ik} = B + fixed Transportation costs + Fixed Testing Costs
  - Total Cost_{ik} = (8,000 + X)* Jet A Cost_{ik} + 8,000*Biofuel Cost_{ik}
  - Yearly Cost_{k} = Total Cost_{1k} + Total Cost_{2k} + …+ Total Cost_{12k}
    - B = Per gallon cost of biofuel. Random variable in which future costs will be forecasted.
    - Biofuel Cost_{ik} = Per gallon cost of ordering biofuel .
    - Fixed Blending Costs = Fixed blending costs per gallon of biofuel.

Option 3 – Analysis Approach



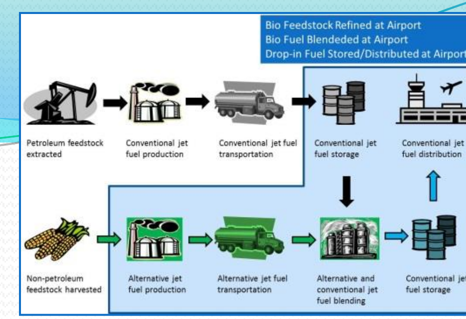
- Cost Model
- Let X = amount of Jet A fuel ordered to be blended with the biofuel inventory to create drop in biofuel.
- Jet A Cost_{ik} = J + F + FET + EXT + VA Motor
- Biofuel Cost_{ik} = fixed Processing Cost_{ik} + fixed Blending Cost_{ik} + FeedStock Cost_{ik}
- Total Cost_{ik} = (8,000 + X)* Jet A Cost_{ik} + 8,000*Biofuel Cost_{ik}
- Yearly Cost_{k} = Total Cost_{1k} + Total Cost_{2k} + …+ Total Cost_{12k}

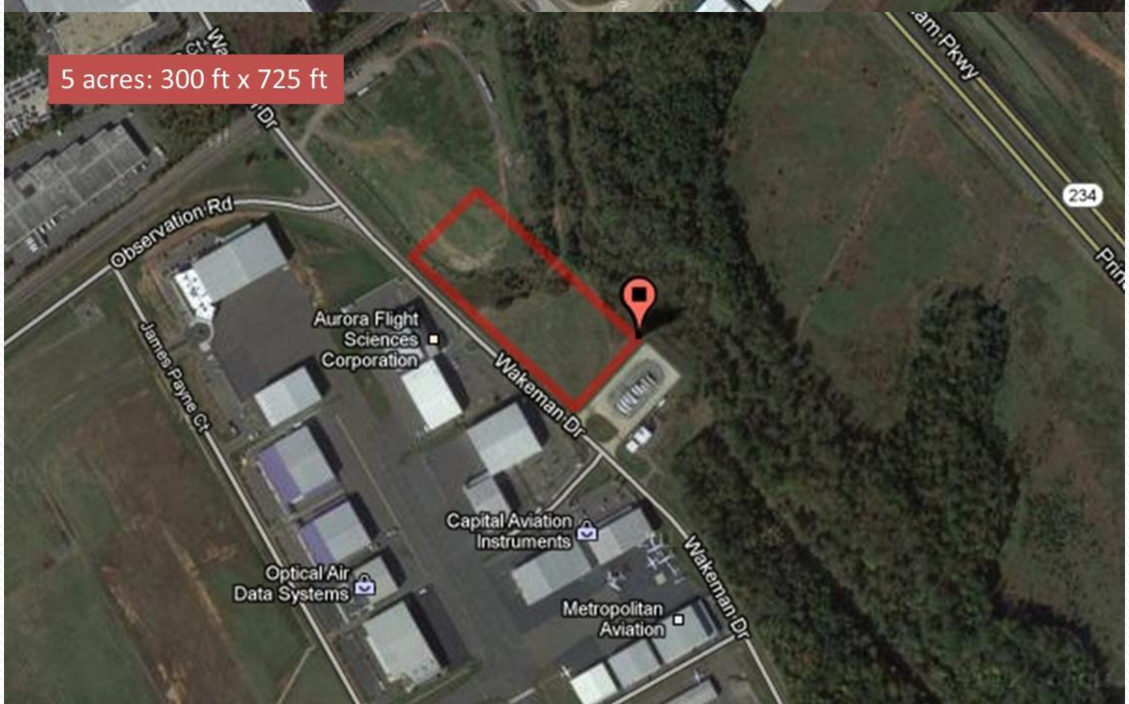
Option 3



- The KHEF Fuel Farm is conveniently and safely located in a corner of the airport property not near active runway and taxiway operations.
- Logistically, it would make sense for Manassas to build a biofuel processing plant near the KHEF fuel farm to limit the amount of additional infrastructure required to transport the biofuel from the processing facility to fuel farm
- The unused land near the KHEF fuel farm is also some of the only unused land on the airport property that is safely separated from airport operations

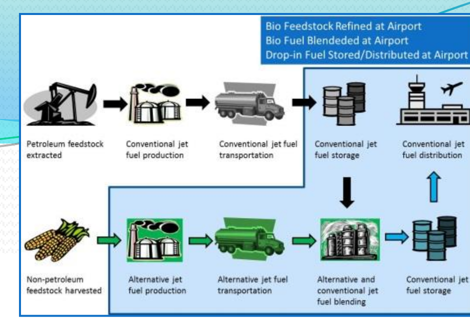
Option 3





- Processing Facilities require 1 – 5 acres of land
- Our fuel usage projections will influence the production capacity of the processing facility, which is a function facility size (in acres)
- Challenges
  - Estimating cost of construction and operation of processing facility – well known for small (personal use) and very large (industrial refining), but not in between
  - Predicting availability of feedstock – market does not yet exist for some desirable feedstock (e.g. algae)

Option 3



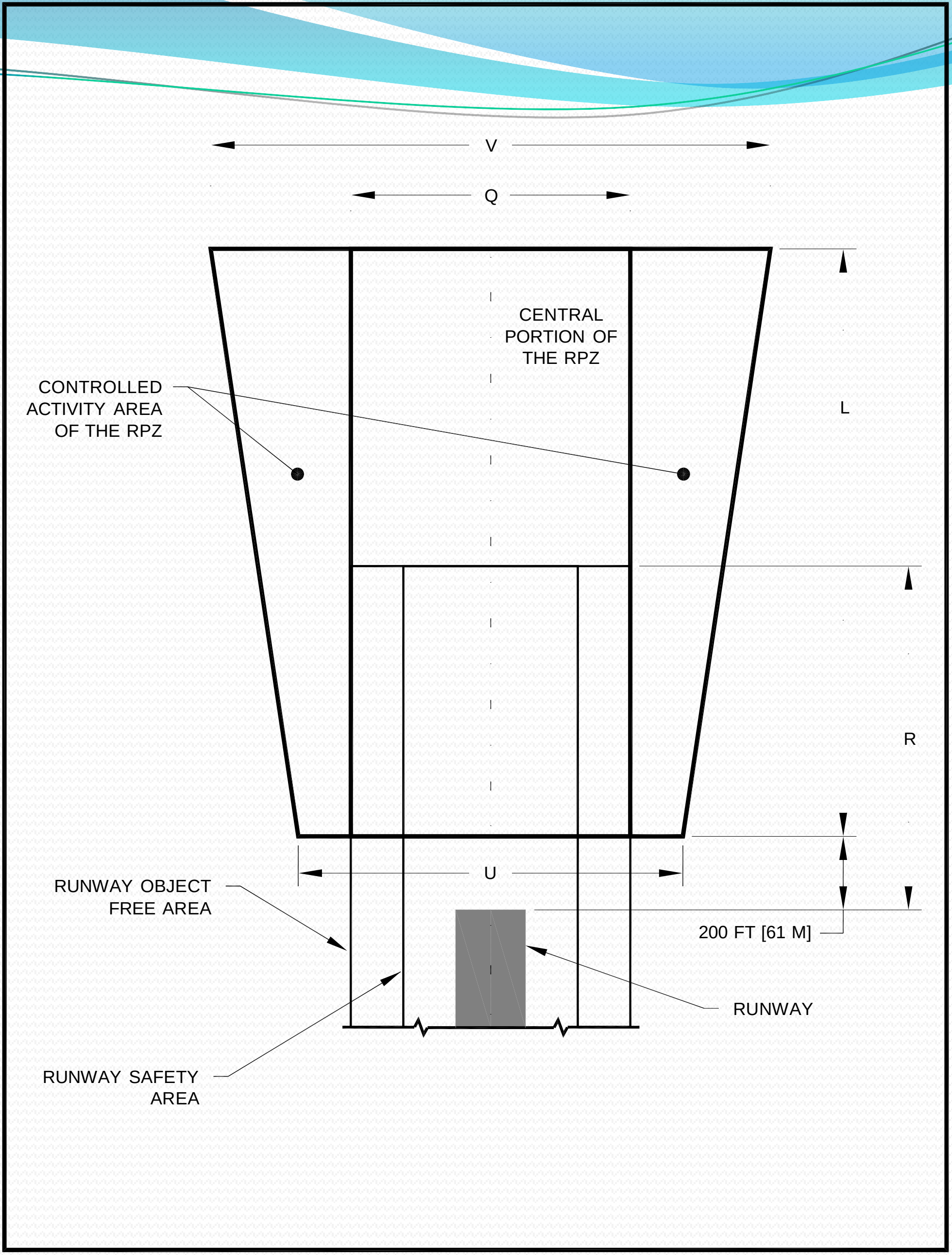
- Proposed bio fuel processing facility location does not interfere with Runway Safety Protection Zone (RPZ)
- Studying land sale prices in the surrounding area can help with estimating land value on which bio fuel processing facility is built

Questions?

Back-Up Slides

Option 3

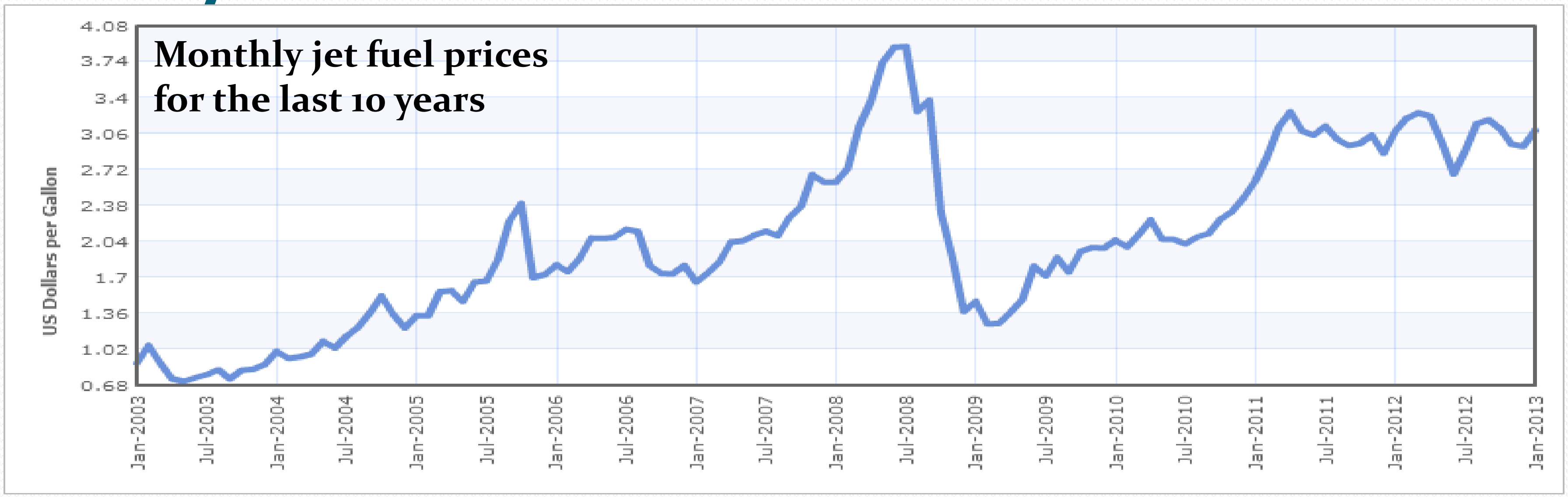
- Runway Safety Protection Zone



Note: See Table 3-8 for dimensions U, V, L, R, and Q.

Figure 3-16. Runway Protection Zone (RPZ)

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

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.

Work Breakdown Structure

- Alternative Jet Fuel Project
  - Project Management
    - Project Control
    - Deliverables
  - Research
    - Alternative Jet Fuel
    - Manassas Airport
    - Data Collection
  - Analysis & Recommendation
    - Comparative Evaluation
      - Stakeholder Analysis
      - Initial Screening
      - Comparative Evaluation
    - Detailed Analysis
      - Supply Chain Modeling
      - Economic Model Development
      - Stochastic Simulation
    - Recommendation

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.