Alaska Aviation Emissions Inventory

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Purpose

- WRAP Emissions Forum is responsible for compiling emission inventories for use in meeting regional haze requirements
- The goal of this project is to improve emission estimates for rural areas of the west
- In Alaska, one potentially significant source of visibility related pollutants is aircraft
- Aircraft travel is commonplace in Alaska
- There are 680 registered airports and an unknown number of smaller airstrips in the State
- Objective is to estimate emissions for all airports in 2002 and summarize results by Borough

Approach

- Identify/review available information sources for
  - activity (LTO data)
  - airport location (i.e., GPS data)
  - airport classification (which airports/airfields are comparable?)
  - aircraft mix (airframe by aviation category)
- Develop framework that
  - organizes known airports into common categories (e.g., international, military, regional hubs, etc.)
  - takes advantage of existing data sources
  - identifies data gaps
  - provides basis to select representative airfields

Approach (con't)

- Conduct surveys to collect information on seasonal activity and aircraft mix for representative airfields
- Use results to compute emissions for representative airfields
- Extrapolate results to similar sized airfields
- Identify location of all airports/airfields within each Borough
- Sum emissions by Borough and season
- Document results

Key Issues to be Resolved

- Determine total number of airports located in the state
  - existing records indicate a total of 1,241 identified airports
  - old FAA publication “Flight Tips for Pilots in Alaska” indicates there 600 known airports and more than 3,000 airstrips in the State
- Obtaining data from available sources in a timely manner (many different information sources – military, FAA, ADOT&PF, survey, etc.)
- Identify information sources for seasonal activity
- Resolve inconsistencies in activity data (e.g., data available for different years)
- Determine Borough specific ceiling height values to govern emission calculations

Summary of Airport Identification, Location and Activity Data Sources

Airport Identification and Location Data Sources		
Data Source	**Description**	**Facilities**
FAA NFDC Database	Compilation of FAA Airport Records	690
1994 ADOT&PF Survey	Statewide Aviation Survey	551
Total Airports Identified		1,241

Summary of Airport Identification, Location and Activity Data Sources (con't)

Aviation Activity Data Sources Used to Estimate 2002 Activity		
Data Source	**Description**	**Facilities**
FAA TAF	2002 Category-Specific Activity	251
FAA NFDC	Category-Specific Activity as of August 2004	230
1994 ADOT&PF Survey	1994 Category-Specific Activity	39
Sierra/CH2M HILL Airport Survey	Survey of Representative Airport to Estimate Current Activity	721
Total Airports		1,241

Seasonal Activity Data Sources

- FAA's Air Traffic Activity Data System (ATADS) has monthly stats for airports with FAA-contracted traffic control towers:
  - Kodiak Airport
  - King Salmon Airport
  - Anchorage International Airport
  - Bethel Airport
  - Kenai Municipal Airport
  - Fairbanks International Airport
  - Juneau International Airport
  - Merrill Field

Seasonal Activity Data Sources (con't)

- Monthly activities for these airports used to represent seasonal activity for similar sized airports
- None of these airports are representative of smaller airfields
- Surveys were used to obtain seasonal data for these airfields

Results of General Airport Survey

Airstrip Type	Observations
Private & Unregistered	• Summer activity only • Fields are not maintained • Small single engine aircraft • 2-3 LTO's per week
Private & Registered	• Airstrips are typically seasonal businesses • Activity is typically 3 – 4 LTO's per day
Other Classified Small DOT&PF Airports	• Limited local based private planes • Usually have one regular scheduled service. • 10 – 15 LTO's per week per year

Results of General Airport Survey (con't)

Airstrip Type	Observations
Community/District DOT&PF Classified Airports	• Cargo, passenger and private aircraft • 18 LTO's per day. • More activity during the summer than winter
Heliports	• No ground support equipment • 2 – 3 LTO's per week for large hospitals • 1 – 2 LTO's per month for smaller hospitals • 3 LTO's per week (winter) • Up to 26 LTO's per day (summer)

Interpretation of General Survey Results

- Discussions with personnel at 42 small airfields and 3 heliports could not identify any airfields that were not included in the list of 1,242 known airfields
- No reason to assume that additional unknown airfields exist

Interpretation of General Survey Results (con't)

- Based on information obtained in survey and review of available data sources the following airport classification system was adopted
  - International (e.g. Anchorage International)
  - Military (e.g., Eielson AFB)
  - Regional Hub (e.g., Ralph Wien Memorial Airport in Kotzebue)
  - Sub Regional Hub (e.g., Aniak Airport)
  - Small Airport With Commercial Traffic (e.g., Stony River Airport)
  - Small Airport Without Commercial Traffic (e.g., Campbell Airstrip in Anchorage)
  - Heliport (e.g., North Douglas Helicopter in Juneau)

Typical Airport Activity Based On Profile Survey Results

Profile	Observed Activity Characteristics		
	Commercial	**General Aviation**	**Military**
Regional	Substantial Air Carrier & Air Taxi Activity	Substantial Activity	Some Activity
Sub-Regional	Some Air Carrier, Substantial Air Taxi	Some to Substantial	None to Some Activity
Small (Some Commercial)	No Air Carrier, None to Substantial Air Taxi Activity	Seasonal to Some Activity	None to Few Flights

Typical Airport Activity Based On Profile Survey Results (con't)

Profile	Observed Activity Characteristics		
	Commercial	General Aviation	Military
Small (No Commercial)	None	Some to Substantial Activity	None
Heliport	All Commercial Helicopter Activity	None	None

Typical Airframe Models Per Airport Profile Based on Survey Results

Profile	Aircraft Category		
	Commercial	General	Military
Regional Hub	B737 King Air B1900 C208 Navajo C207 C180	C180 C172 C207	C130 King Air H60 Blackhawk
Sub-Regional Hub	B1900 Navaho C207 C208 King Air B737	C172 C180	C-130 B1900 C208 Navaho H60 Blackhawk

Typical Airframe Models Per Airport Profile Based on Survey Results (con't)

Profile	Aircraft Category		
	Commercial	General	Military
Small	C207 King Air, B1900 C208 C172	C172 C180	N/A
Heliport	Bell 204 Bell 212 AS350 Hughes 500	N/A	N/A

Survey Results for Military Facilities

Elmendorf AFB

- Activity and emissions from 2002 Mobile Source Air Emissions Inventory (prepared by U.S. Air Force)
- Aircraft included jet, large cargo and single/multi engine GA
- No information on seasonal activity

Fort Wainwright Army Post

- 34,427 LTO's in 2004 (based on data from Post Operations)
- Aircraft included, jet, large cargo and single/multi engine GA
- 67% of activity in the summer and 33% in the winter
- GSE includes fuel tankers, APU's and tractors

Survey Results for Military Facilities (con't)

Fort Richardson Army Post

- Emissions included in Elmendorf estimate

Eielson AFB

- No response to data requests

Coast Guard Air Station Kodiak

- Joint civil/military facility
- FAA LTO data available
- Military aircraft includes helicopters and large cargo planes

Emission Inventory Development

General Approach

- Use FAA's Emissions and Dispersion Modeling System (EDMS 4.2) to compute emissions for HC, CO and NOx
- Use 1985 National Acid Precipitation Assessment Program (NAPAP) emission factors for PM
- Ammonia (NH3) emissions
  - negligible for aircraft turbine engines
  - use non-catalyzed motor vehicle data as surrogate for piston aircraft

Emission Inventory Development (con't)

General Approach

- Use EDMS to compute emissions for
  - International Airports using FAA data
  - Regional Airports using FAA data where available and for survey profiles of representative airports
  - Sub-Regional Airports using FAA data where available and for survey profiles of representative airports
  - Small Airports (with and without commercial activity) for survey profiles of representative airports
  - Heliports for survey profiles of representative airports

Emission Inventory Development (con't)

General Approach

- Use military emission estimates where available, compute emissions for those facilities where LTO and profile data area available and extrapolate results to those without activity data
- Extrapolate results of profile airports to similar category airports

Emission Inventory Development (con't)

Seasonal Allocation

- Use FAA TAF data for international and military airports
- Define winter as October – March and summer as April – September
- Develop seasonal profiles (i.e. % split) for remaining categories using ATADS data and survey results for representative airports
- Apply profiles to similar airports

Emission Inventory Development (con't)

Airport Location

- Combination of data sources used to determine Borough assignment (NFDC and 1994 DOT survey)
- Inconsistencies checked against USGS Geographic Names Information System
- Location of 13 airports could not be identified

Distribution of Airports/Airstrips

Borough	Facilities	
	Number	Percent of Total
Aleutians East	22	1.8%
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Anchorage	42	3.4%
Bethel	67	5.4%
Bristol Bay	9	0.7%
Denali	21	1.7%
Dillingham	33	2.7%
Fairbanks North Star	41	3.3%
Haines	8	0.6%
Juneau	12	1.0%
Kenai Peninsula	89	7.2%

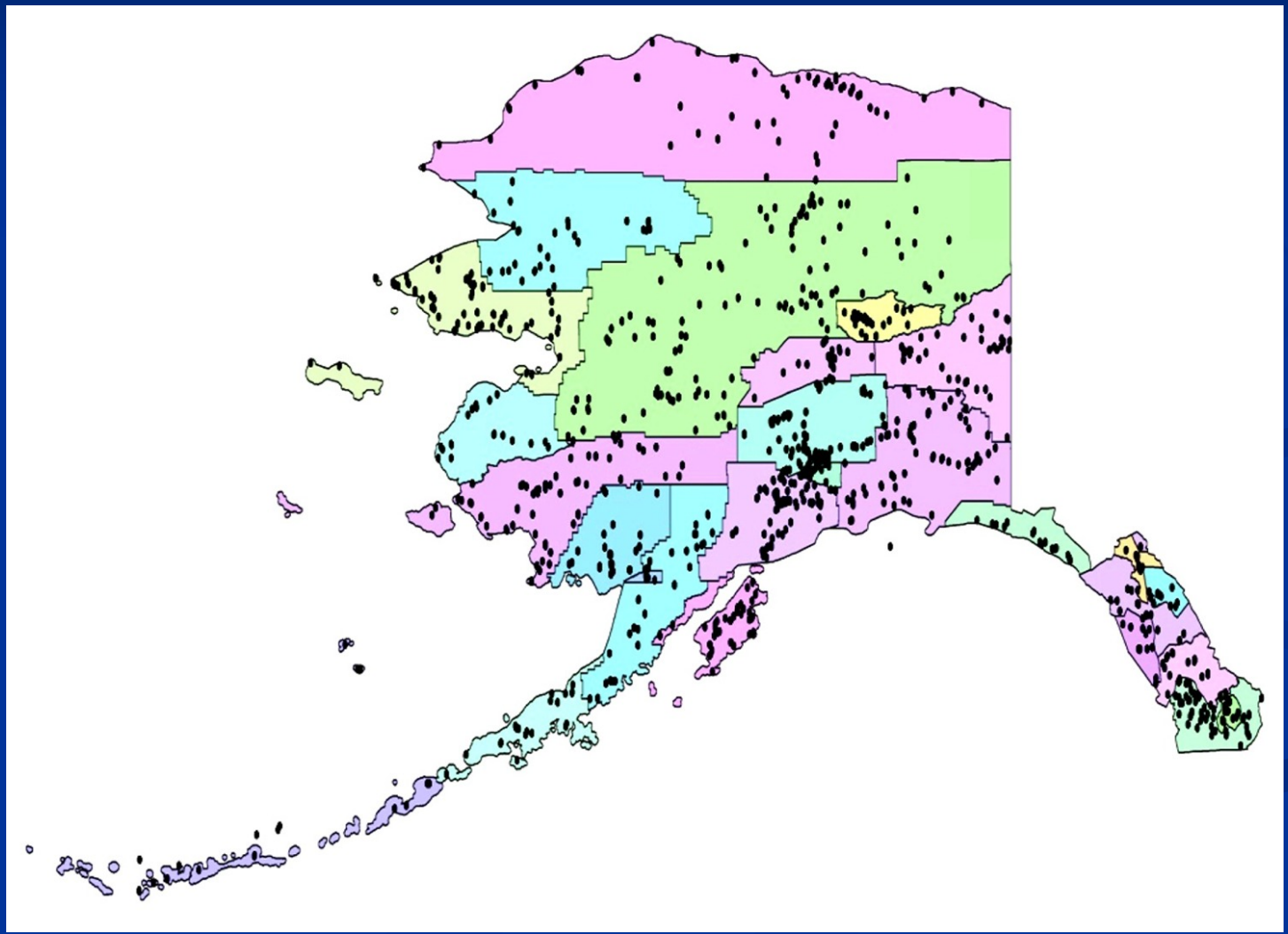
Distribution of Airports/Airstrips (con't)

Borough	Facilities	
	Number	Percent of Total
Ketchikan Gateway	17	1.4%
Kodiak Island	44	3.5%
Lake and Peninsula	39	3.1%
Matanuska-Susitna	189	15.2%
Nome	70	5.6%
North Slope	69	5.6%
Northwest Arctic	26	2.1%
Prince of Wales-Outer Ketchikan	58	4.7%
Sitka	11	0.9%
Skagway-Hoonah-Angoon	20	1.6%
Southeast Fairbanks	40	3.2%

Distribution of Airports/Airstrips (con't)

Borough	Facilities	
	Number	Percent of Total
Valdez-Cordova	91	7.3%
Wade Hampton	23	1.9%
Wrangell-Petersburg	18	1.5%
Yakutat	12	1.0%
Yukon-Koyukuk	135	10.9%
Unknown	13	1.0%
Total	1,241	100%

Distribution of Alaska Airports by Boroughs



Emissions Summary

Distribution of Aviation Emissions by Season						
Season	Emissions in Tons Per Day					
	CO	HC	NO_x	SO_x	PM	NH_3
Winter	27.1	2.8	5.6	0.6	1.2	0.007
Summer	90.3	5.8	12.3	1.3	2.5	0.032

Emissions Summary (con't)

- All pollutants are higher during the summer because of
  - increased activity
  - higher ceiling heights (extends time in climb-out and approach mode)
- Highest levels of emissions are found in Anchorage in the summer and winter (e.g., 73%/74% of NOx emissions)
- Similarly, activity levels at International Airports in Fairbanks and Juneau make their Boroughs among the highest in the state
- Mat-Su and YK have emission levels similar to Fairbanks and Juneau because of the large number of airports located within their borders