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BUREAU OF AIR REGULATION

AIR PERMIT APPLICATION AND PREVENTION OF SIGNIFICANT DETERIORATION ANALYSIS FOR LOX/KEROSENE ROCKET ENGINE STAND PROJECT PRATT & WHITNEY

Prepared For:

United Technologies-Pratt & Whitney
17900 Beeline Highway.
Jupiter, Florida 33478

Prepared By:

Golder Associates Inc.
1801 Clint Moore Road, Suite 200
Boca Raton, Florida 33487

June 2000
9939571Y/F1

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7 Copies - Florida Department of Environmental Protection
2 Copies – Pratt & Whitney
1 Copy – Palm Beach County Health Unit
2 Copies – Golder Associates Inc.

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LIST OF ACROYNMS AND ABBREVIATIONS

AAQS	ambient air quality standards
BACT	best available control technology
°C	degrees Celsius
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	carbon monoxide
DEP	Department of Environmental Protection
EPA	U.S. Environmental Protection Agency
F.A.C.	Florida Administrative Code
ft	foot
ft/sec	feet per second
GEP	good engineering practice
Golder	Golder Associates Inc.
HSH	highest, second-highest
ISCST3	Industrial Source Complex Short-term
kg	kilogram
kgf	kilogram force
kg/sec	kilograms per second
km	kilometer
lbm/sec	pound mass per second
m	meter
m^3	cubic meters
m/s	meters per second
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NPS	National Park Service
NSPS	New Source Performance Standards
NSR	new source review
NWA	National Wilderness Area

LIST OF ACROYNMS AND ABBREVIATIONS

NWS	National Weather Service
O_3	ozone
PM	particulate matter
PM_{10}	particulate matter with aerodynamic diameter of 10 microns or less
ppm	parts per million
PSD	prevention of significant deterioration
psia	pound per square inch atmospheric
SCRAM	Support Center for Regulatory Air Models
SIP	State Implementation Plan
SO_2	sulfur dioxide
TPY	tons per year
TSP	total suspended particulate matter
TTN	Technical Transfer Network
$\mu g/m^3$	micrograms per cubic meter
USC	United States Code
VOC	volatile organic compound

PART A

AIR PERMIT APPLICATION

Department of
Environmental Protection

Division of Air Resources Management

APPLICATION FOR AIR PERMIT - TITLE V SOURCE

See Instructions for Form No. 62-210.900(1)

I. APPLICATION INFORMATION

Identification of Facility

1. Facility Owner/Company Name: **United Technologies Corporation/Pratt & Whitney**	
2. Site Name: **Pratt & Whitney**	
3. Facility Identification Number: **0990021** [ ] Unknown	
4. Facility Location: **Pratt & Whitney** Street Address or Other Locator: **17900 Beeline Highway (SR 710)** City: **Jupiter** County: **Palm Beach** Zip Code: **33478**	
5. Relocatable Facility? [ ] Yes [X] No	6. Existing Permitted Facility? [X] Yes [ ] No

Application Contact

1. Name and Title of Application Contact: **Dale Francke, Environmental Project Engineer**
2. Application Contact Mailing Address: Organization/Firm: **UTC/Pratt & Whitney** Street Address: **17900 Beeline Highway (SR 710)** City: **Jupiter** State: **FL** Zip Code: **33478**
3. Application Contact Telephone Numbers: Telephone: (**561**) **796-3733** Fax: (**561**) **796-2787**

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	6-20-00
2. Permit Number:	0990021-004-AC
3. PSD Number (if applicable):	PSD-FL-294
4. Siting Number (if applicable):	

Purpose of Application

Air Operation Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[ ] Initial Title V air operation permit for an existing facility which is classified as a Title V source.

[ ] Initial Title V air operation permit for a facility which, upon start up of one or more newly constructed or modified emissions units addressed in this application, would become classified as a Title V source.

Current construction permit number:______________________________

[ ] Title V air operation permit revision to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number:______________________________

Operation permit number to be revised:______________________________

[ ] Title V air operation permit revision or administrative correction to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application. (Also check Air Construction Permit Application below.)

Operation permit number to be revised/corrected:______________________

[ ] Title V air operation permit revision for reasons other than construction or modification of an emissions unit. Give reason for the revision; e.g., to comply with a new applicable requirement or to request approval of an "Early Reductions" proposal.

Operation permit number to be revised:______________________________

Reason for revision:______________________________________

Air Construction Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[X] Air construction permit to construct or modify one or more emissions units.

[ ] Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

[ ] Air construction permit for one or more existing, but unpermitted, emissions units.

Owner/Authorized Representative or Responsible Official

1. Name and Title of Owner/Authorized Representative or Responsible Official:
   John K. Sillan, Manager Facilities Management

2. Owner/Authorized Representative or Responsible Official Mailing Address:
   Organization/Firm: **United Technologies Corp – Pratt & Whitney**
   Street Address: **P.O. Box 109600**
   City: **West Palm Beach** State: **FL** Zip Code: **33410-9600**

3. Owner/Authorized Representative or Responsible Official Telephone Numbers:
   Telephone: (**561**) **796-2626** Fax: (**561**) **796-2787**

4. Owner/Authorized Representative or Responsible Official Statement:

   I, the undersigned, am the owner or authorized representative(check here [X], if so) or the responsible official (check here [ ], if so) of the Title V source addressed in this application, whichever is applicable. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions unit.*

   John Sillan ________________ June 9, 2000 ________________
   Signature Date

* Attach letter of authorization if not currently on file.

Professional Engineer Certification

1. Professional Engineer Name: **Benny Susi**
   Registration Number: **35042**

2. Professional Engineer Mailing Address:
   Organization/Firm: **Golder Associates Inc.**
   Street Address: **1801 Clint Moore Rd, Suite 200**
   City: **Boca Raton** State: **FL** Zip Code: **33487**

3. Professional Engineer Telephone Numbers:
   Telephone: (**561**) **994 - 9910** Fax: (**561**) **994 - 9393**

4. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

If the purpose of this application is to obtain a Title V source air operation permit (check here [ ], if so), I further certify that each emissions unit described in this Application for Air Permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance schedule is submitted with this application.

If the purpose of this application is to obtain an air construction permit for one or more proposed new or modified emissions units (check here [X], if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

If the purpose of this application is to obtain an initial air operation permit or operation permit revision for one or more newly constructed or modified emissions units (check here [ ], if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

[signature] 6-6-2000

Signature Date

(seal)

* Attach any exception to certification statement.

Scope of Application

Emissions Unit ID	Description of Emissions Unit	Permit Type	Processing Fee
--	LOX/kerosene Rocket Engine Stand	AC1A	7,500

Application Processing Fee

Check one: [X] Attached - Amount: $: 7,500 [ ] Not Applicable

Construction/Modification Information

1. Description of Proposed Project or Alterations: **Addition of a new LOX/kerosene Rocket Engine Stand.**	
2. Projected or Actual Date of Commencement of Construction: **1 Apr 01**	
3. Projected Date of Completion of Construction: **1 Apr 03**	

Application Comment

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates: Zone: **17** East (km): **567.3** North (km): **2974.4**			
2. Facility Latitude/Longitude: Latitude (DD/MM/SS): **26 / 53 / 28** Longitude (DD/MM/SS): **80 / 19 / 20**			
3. Governmental Facility Code: **0**	4. Facility Status Code: **C**	5. Facility Major Group SIC Code: **37**	6. Facility SIC(s): **3724**
7. Facility Comment (limit to 500 characters): **See Attachment A**			

Facility Contact

1. Name and Title of Facility Contact: **Dale Francke, Environmental Project Manager**
2. Facility Contact Mailing Address: Organization/Firm: **UTC/Pratt & Whitney** Street Address: **P.O. Box 109600** City: **West Palm Beach** State: **FL** Zip Code: **33410-9600**
3. Facility Contact Telephone Numbers: Telephone: (**561**) **796-3733** Fax: (**561**) **796-2787**

Facility Regulatory Classifications

Check all that apply:

1. [ ] Small Business Stationary Source?	[ ] Unknown
2. [X] Major Source of Pollutants Other than Hazardous Air Pollutants (HAPs)?	
3. [ ] Synthetic Minor Source of Pollutants Other than HAPs?	
4. [X] Major Source of Hazardous Air Pollutants (HAPs)?	
5. [ ] Synthetic Minor Source of HAPs?	
6. [X] One or More Emissions Units Subject to NSPS?	
7. [X] One or More Emission Units Subject to NESHAP?	
8. [ ] Title V Source by EPA Designation?	
9. Facility Regulatory Classifications Comment (limit to 200 characters):	

List of Applicable Regulations

Not Applicable	

B. FACILITY POLLUTANTS

List of Pollutants Emitted

1. Pollutant Emitted	2. Pollutant Classif.	3. Requested Emissions Cap lb/hour	tons/year	4. Basis for Emissions Cap	5. Pollutant Comment
CO	**A**				**Carbon Monoxide**

C. FACILITY SUPPLEMENTAL INFORMATION

Supplemental Requirements

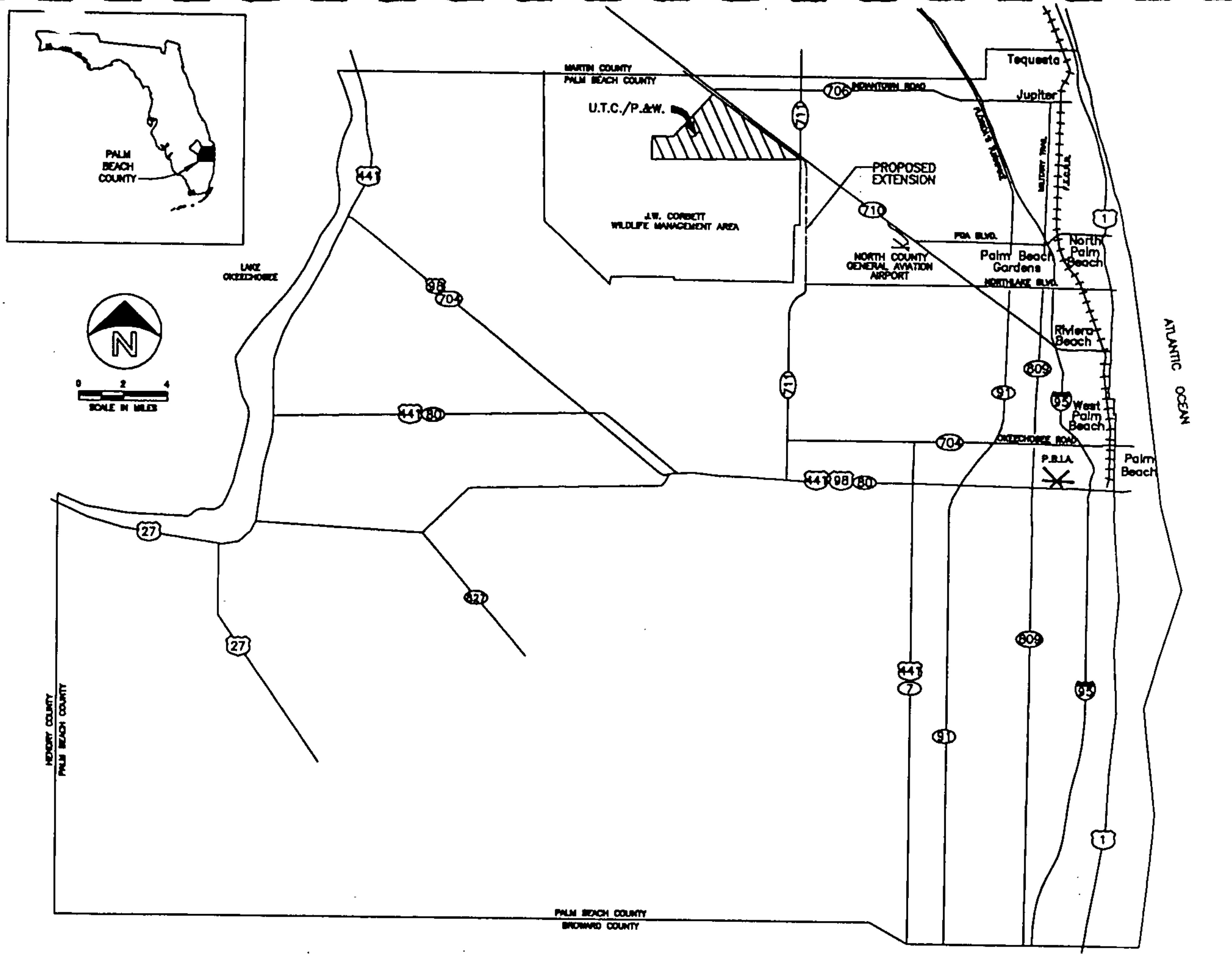
1. Area Map Showing Facility Location: [X] Attached, Document ID: PW-FI-C1 [ ] Not Applicable [ ] Waiver Requested	
2. Facility Plot Plan: [X] Attached, Document ID: PW-FI-C2 [ ] Not Applicable [ ] Waiver Requested	
3. Process Flow Diagram(s): [X] Attached, Document ID: PW-FI-C3 [ ] Not Applicable [ ] Waiver Requested	
4. Precautions to Prevent Emissions of Unconfined Particulate Matter: [ ] Attached, Document ID: ______ [X] Not Applicable [ ] Waiver Requested	
5. Fugitive Emissions Identification: [ ] Attached, Document ID: ______ [X] Not Applicable [ ] Waiver Requested	
6. Supplemental Information for Construction Permit Application: [ ] Attached, Document ID: ______ [X] Not Applicable	
7. Supplemental Requirements Comment:	

Additional Supplemental Requirements for Title V Air Operation Permit Applications

8. List of Proposed Insignificant Activities: [ ] Attached, Document ID:_______ [ ] Not Applicable	
9. List of Equipment/Activities Regulated under Title VI: [ ] Attached, Document ID:_______ [ ] Equipment/Activities On site but Not Required to be Individually Listed [ ] Not Applicable	
10. Alternative Methods of Operation: [ ] Attached, Document ID:_______ [ ] Not Applicable	
11. Alternative Modes of Operation (Emissions Trading): [ ] Attached, Document ID:_______ [ ] Not Applicable	
12. Identification of Additional Applicable Requirements: [ ] Attached, Document ID:_______ [ ] Not Applicable	
13. Risk Management Plan Verification: [ ] Plan previously submitted to Chemical Emergency Preparedness and Prevention Office (CEPPO). Verification of submittal attached (Document ID:_______) or previously submitted to DEP (Date and DEP Office:_____________________) [ ] Plan to be submitted to CEPPO (Date required:_____________________) [ ] Not Applicable	
14. Compliance Report and Plan: [ ] Attached, Document ID:_______ [ ] Not Applicable	
15. Compliance Certification (Hard-copy Required): [ ] Attached, Document ID:_______ [ ] Not Applicable	

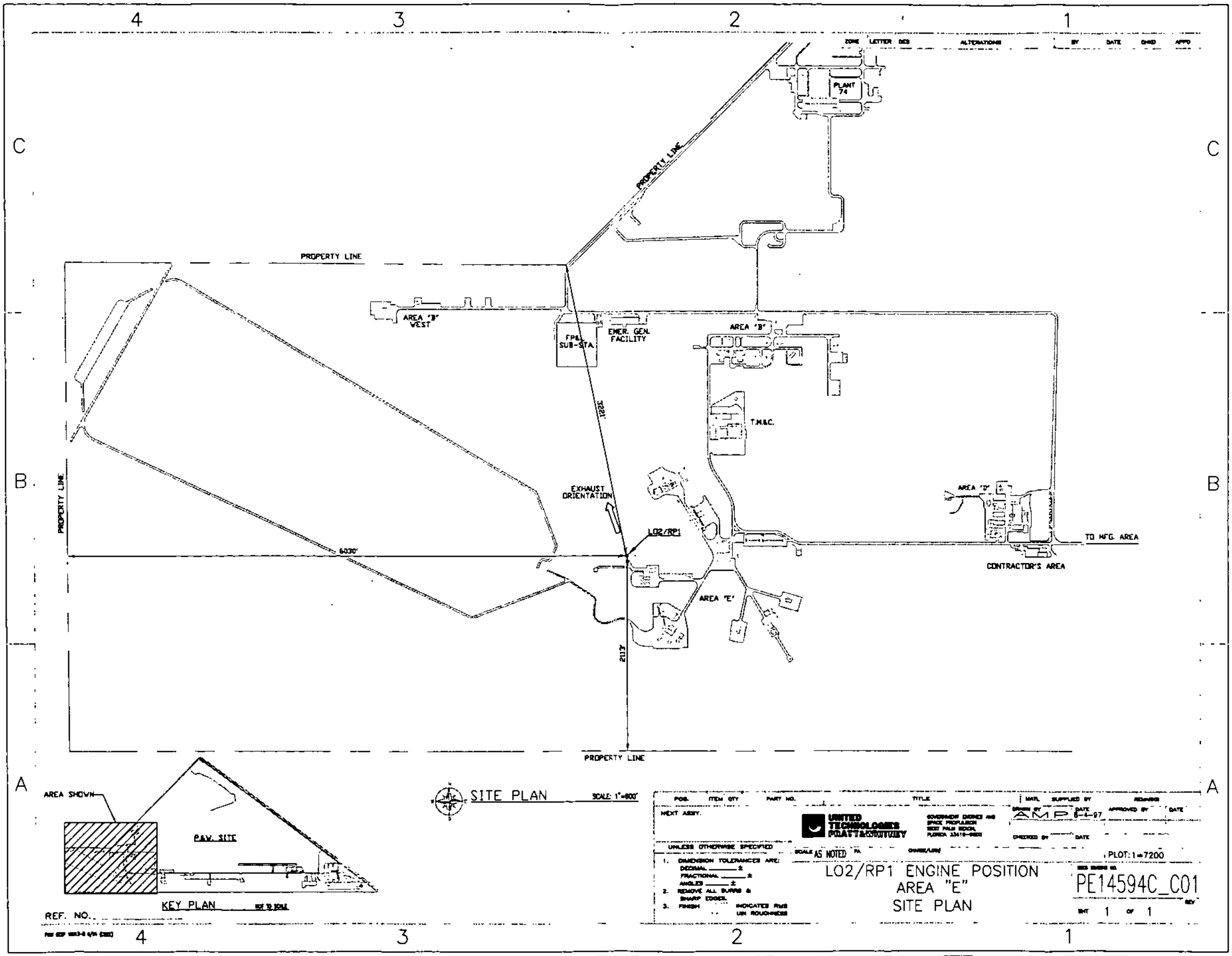
ATTACHMENT PW-FI-C1

AREA MAP


PALM BEACH COUNTY
MARTIN COUNTY
PALM BEACH COUNTY
U.T.C./P.&W.
706
INDIANTOWN ROAD
711
Tequesta
Jupiter
PROPOSED EXTENSION
J.W. CORBETT WILDLIFE MANAGEMENT AREA
710
PGA BLVD.
NORTH COUNTY GENERAL AVIATION AIRPORT
North Palm Beach
Palm Beach Gardens
NORTHLAKE BLVD.
LAKE OKEECHOBEE
441
98
704
Riviera Beach
809
91
95
West Palm Beach
80
OKEECHOBEE ROAD
P.B.I.A.
Palm Beach
ATLANTIC OCEAN
N
0 2 4
SCALE IN MILES
27
827
7
1
HENDRY COUNTY
PALM BEACH COUNTY
BROWARD COUNTY

ATTACHMENT PW-FI-C2

FACILITY PLOT PLAN



Attachment PW-FI-C2. General Location

Filename: 9939571Y/F1/WP/figure1-1.dwg
Last Updated: 5/23/2000 by ARZ

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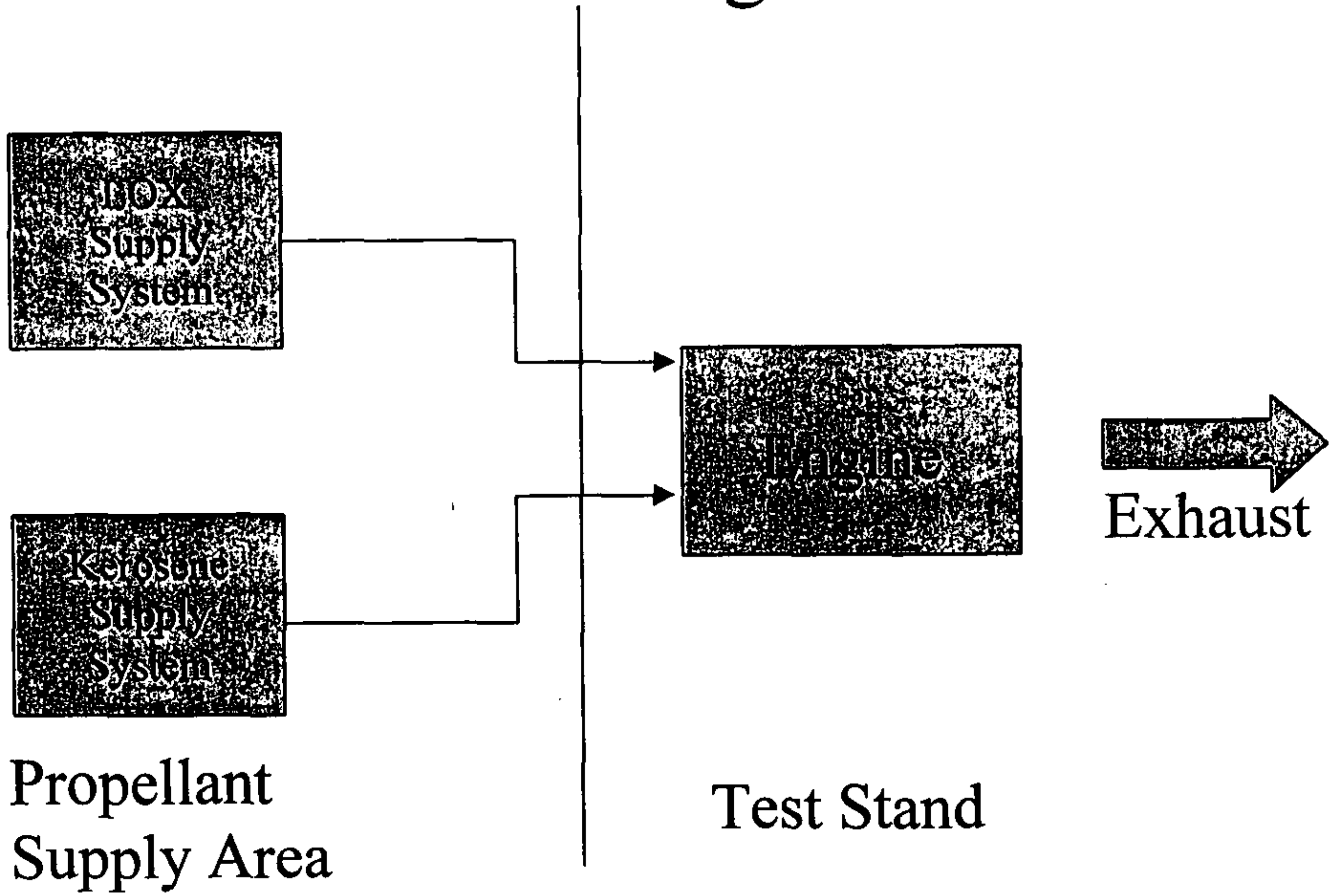
ATTACHMENT PW-FI-C3

PROCESS FLOW DIAGRAM

LOX/Kerosene Engine Stand Process Diagram



Attachment PW-FI-C3
Process Flow Diagram

Golder Associates

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through J as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION
(All Emissions Units)

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in This Section: (Check one)

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[X] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Regulated or Unregulated Emissions Unit? (Check one)

[ ] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[X] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

3. Description of Emissions Unit Addressed in This Section (limit to 60 characters):

LOX/kerosene rocket engine stand

4. Emissions Unit Identification Number: [X] No ID
ID: [ ] ID Unknown

5. Emissions Unit Status Code:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
C		**37**	[ ]

9. Emissions Unit Comment: (Limit to 500 Characters)

This emission unit consists of a LOX/kerosene rocket engine stand used for testing rocket engines that use liquid oxygen (LOX) and kerosene propellants. Exhaust is directed through a water-cooled silencer and a deflector.

Emissions Unit Control Equipment

1. Control Equipment/Method Description (Limit to 200 characters per device or method):
2. Control Device or Method Code(s):

Emissions Unit Details

1. Package Unit: Manufacturer:	Model Number:
2. Generator Nameplate Rating:	MW
3. Incinerator Information: Dwell Temperature: Dwell Time: Incinerator Afterburner Temperature:	 °F seconds °F

B. EMISSIONS UNIT CAPACITY INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate:				mmBtu/hr
2. Maximum Incineration Rate:		lb/hr		tons/day
3. Maximum Process or Throughput Rate:				
4. Maximum Production Rate:			318,000	gal
5. Requested Maximum Operating Schedule:				
	24	hours/day	7	days/week
	52	weeks/year	8,760	hours/year

6. Operating Capacity/Schedule Comment (limit to 200 characters):

Throughput relates to fuel consumption per year. For 12 rocket tests kerosene = 318,000 gal.

C. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

List of Applicable Regulations

62-210.300(1) – Air construction permits
62-210.300(2) – Air operation permits

D. EMISSION POINT (STACK/VENT) INFORMATION
(Regulated Emissions Units Only)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram? **EU1**	2. Emission Point Type Code: **4**
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):	
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:	

5. Discharge Type Code:	6. Stack Height: feet	7. Exit Diameter: feet
8. Exit Temperature: °F	9. Actual Volumetric Flow Rate: acfm	10. Water Vapor: %

11. Maximum Dry Standard Flow Rate: dscfm	12. Nonstack Emission Point Height: feet

13. Emission Point UTM Coordinates:

Zone: East (km): North (km):

14. Emission Point Comment (limit to 200 characters):

See Attachment A

E. SEGMENT (PROCESS/FUEL) INFORMATION
(All Emissions Units)

Segment Description and Rate: Segment 1 of 1

1. Segment Description (Process/Fuel Type) (limit to 500 characters): **Internal combustion engines – engine testing. Rocket engine.**		
2. Source Classification Code (SCC): **2-04-002-02**	3. SCC Units: **tons of fuel**	
4. Maximum Hourly Rate: **1,334**	5. Maximum Annual Rate: **1067**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment (limit to 200 characters): **Maximum hourly rate is based on a maximum annual fuel consumption of 1067 tons of kerosene.**		

Segment Description and Rate: Segment ____ of ____

1. Segment Description (Process/Fuel Type) (limit to 500 characters):		
2. Source Classification Code (SCC):	3. SCC Units:	
4. Maximum Hourly Rate:	5. Maximum Annual Rate:	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment (limit to 200 characters):		

F. EMISSIONS UNIT POLLUTANTS
(All Emissions Units)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
CO			NS

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **CO**	2. Total Percent Efficiency of Control: **%**
3. Potential Emissions: **2.5 million** lb/hour **1000** tons/year	4. Synthetically Limited? [**X**]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 ______ to ______ tons/year	
6. Emission Factor: **See Attachment A** Reference:	7. Emissions Method Code: **2**

8. Calculation of Emissions (limit to 600 characters):

CO = 694.4 lb/sec x 240 sec/test x 12 test/year x ton/2000 lb = 1000 TPY

CO = 1000 TPY x 2000 lb/ton x year/12 tests x test/240 sec x 60 sec/min x 60 min/hr = 2.5 million lb/hr

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Potential emissions are based on throughput of 1067 tons of fuel per year.

Allowable Emissions Allowable Emissions ______ of ______

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation ____ of ____

1. Visible Emissions Subtype:	2. Basis for Allowable Opacity: [ ] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance:	
5. Visible Emissions Comment (limit to 200 characters):	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor ____ of ____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	[ ] Rule [ ] Other
4. Monitor Information: Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters):	

J. EMISSIONS UNIT SUPPLEMENTAL INFORMATION
(Regulated Emissions Units Only)

Supplemental Requirements

1. Process Flow Diagram [X] Attached, Document ID: PW-FI-C3 [ ] Not Applicable [ ] Waiver Requested
2. Fuel Analysis or Specification [ ] Attached, Document ID:________ [X] Not Applicable [ ] Waiver Requested
3. Detailed Description of Control Equipment [ ] Attached, Document ID: ________ [X] Not Applicable [ ] Waiver Requested
4. Description of Stack Sampling Facilities [ ] Attached, Document ID:________ [X] Not Applicable [ ] Waiver Requested
5. Compliance Test Report [ ] Attached, Document ID:________ [ ] Previously submitted, Date:________ [X] Not Applicable
6. Procedures for Startup and Shutdown [ ] Attached, Document ID:________ [X] Not Applicable [ ] Waiver Requested
7. Operation and Maintenance Plan [ ] Attached, Document ID:________ [X] Not Applicable [ ] Waiver Requested
8. Supplemental Information for Construction Permit Application [X] Attached, Document ID: Attachment A [ ] Not Applicable
9. Other Information Required by Rule or Statute [ ] Attached, Document ID: ________ [X] Not Applicable
10. Supplemental Requirements Comment:

Additional Supplemental Requirements for Title V Air Operation Permit Applications

11. Alternative Methods of Operation [ ] Attached, Document ID:________ [X] Not Applicable
12. Alternative Modes of Operation (Emissions Trading) [ ] Attached, Document ID:________ [X] Not Applicable
13. Identification of Additional Applicable Requirements [ ] Attached, Document ID:________ [X] Not Applicable
14. Compliance Assurance Monitoring Plan [ ] Attached, Document ID:________ [X] Not Applicable
15. Acid Rain Part Application (Hard-copy Required) [ ] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a)) Attached, Document ID:________ [ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.) Attached, Document ID:________ [ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.) Attached, Document ID:________ [ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.) Attached, Document ID:________ [ ] Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.) Attached, Document ID:________ [ ] Phase NOx Averaging Plan (Form No. 62-210.900(1)(a)5.) Attached, Document ID:________ [X] Not Applicable

PART B

ATTACHMENT PSD-SPC

PSD ANALYSIS

1.0 INTRODUCTION

United Technologies Corporation (UTC)-Pratt & Whitney located at 17900 Beeline Highway (SR 710), Jupiter, Palm Beach County, Florida is proposing to construct and operate LOX/kerosene rocket engine stand at the E-5 rocket test area in West Palm Beach, Florida (see Figure 1-1). Pratt & Whitney is a research and development facility that designs gas turbines and rocket engines for the Department of Defense and the National Aeronautics and Space Administration. Gas turbine engine operations include engineering, manufacturing, and testing of prototype engines and parts. Rocket engine operations include engineering, manufacturing, and testing prototype and commercial engines. A Materials Laboratory that develops and tests materials supports both operations.

The project requires an air construction permit and prevention of significant deterioration (PSD) review. To assist in performing the necessary licensing activities, Pratt & Whitney contracted Golder Associates Inc. (Golder) to perform the necessary air quality assessments for determining the project's compliance with state and federal new source review (NSR) regulation. The critical aspects of these assessments include the air quality impact analyses performed using an air dispersion model and the best available control technology (BACT) analyses performed to evaluate the selected emission control technology.

The proposed project is located at a major emitting facility and will be an air pollution source that will result in increases in potential air emissions. The U.S. Environmental Protection Agency (EPA) has implemented regulations for facilities requiring a PSD review. The PSD regulations are promulgated under 10 Code of Federal Regulations (CFR) Part 52.21 and implemented through delegation to the Florida Department of Environmental Protection (DEP). Florida's PSD regulations are codified in Rules 62-212.400, Florida Administrative Code (F.A.C.). Florida's regulations incorporate the EPA PSD regulations.

Based on the emissions from the proposed project, a PSD review is required for carbon monoxide (CO), a regulated pollutant.

Palm Beach County has been designated as an attainment or unclassifiable area for all criteria pollutants [i.e., attainment: ozone (O_3), particulate matter with aerodynamic diameter of 10 microns or less (PM_{10}), sulfur dioxide (SO_2), CO, and nitrogen dioxide (NO_2), and unclassifiable: lead] and is classified as a PSD Class II area for PM_{10}, SO_2, and NO_2; therefore, the PSD review will follow the regulations pertaining to such designations.

The air permit application is divided into seven major sections.

- Section 2.0 presents a description of the new rocket test cell, including exhaust characteristics and stack parameters.
- Section 3.0 summarizes and reviews the PSD requirements applicable to the proposed project.
- Section 4.0 includes the control technology review with discussions on BACT.
- Section 5.0 discusses the ambient air monitoring analysis (pre-construction monitoring) required by PSD regulations.
- Section 6.0 presents a summary of the air modeling approach and results used in assessing compliance of the proposed project with ambient air quality standards (AAQS), PSD increments, and good engineering practice (GEP) stack height regulations.
- Section 7.0 provides the additional impact analyses for soils, vegetation, and visibility.

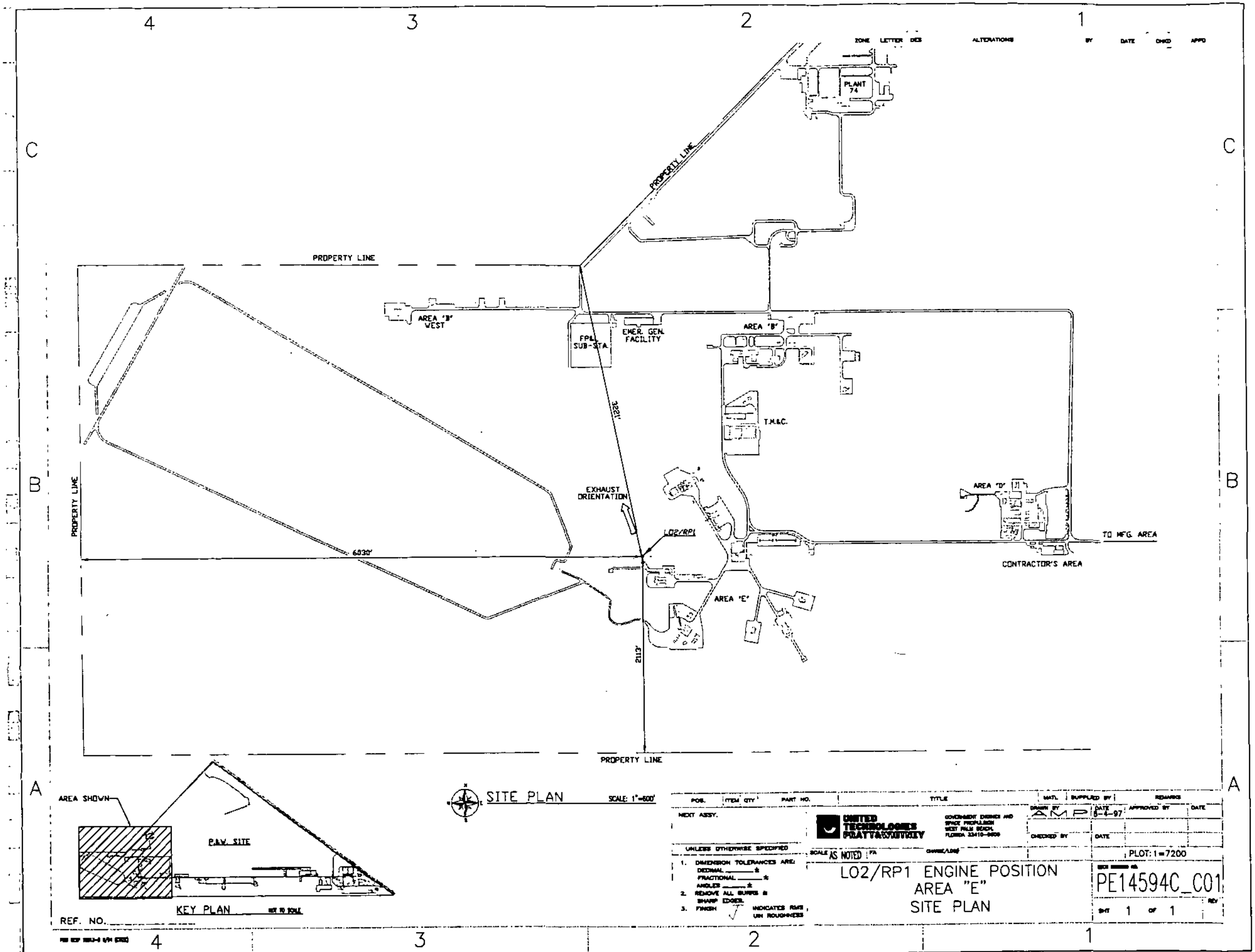
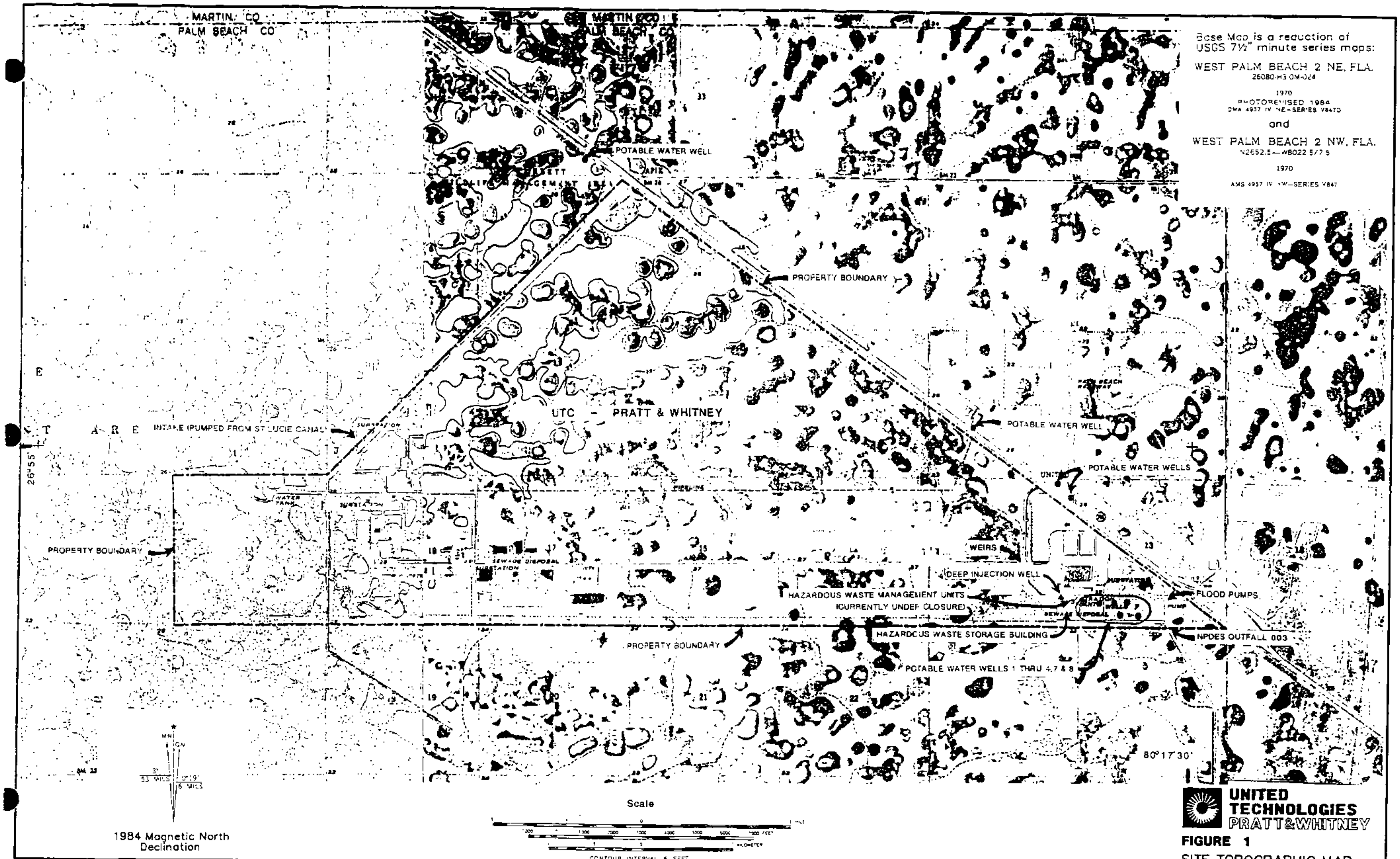


Figure 1-1. General Location

Filename: 9939571Y/F1/WP/figure1-1.dwg
Last Updated: 5/23/2000 by ARZ

Golder Associates



Base Map is a reduction of USGS 7½" minute series maps:

WEST PALM BEACH 2 NE, FLA.

1970

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WEST PALM BEACH 2 NW, FLA.

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UNITED TECHNOLOGIES PRATT&WHITNEY

FIGURE 1

SITE TOPOGRAPHIC MAP

2.0 PROJECT DESCRIPTION

2.1 EXISTING SITE DESCRIPTION

Pratt & Whitney operates a research and development facility that designs gas turbines and rocket engines for the Department of Defense and the National Aeronautics and Space Administration in West Palm Beach, Florida. The existing Pratt & Whitney facility consists of the manufacturing, testing, and Sikorsky helicopter areas in which the potential air pollutants are likely to be emitted. These areas which are designed to serve aircraft and rocket engine research and development, have received permits from Florida DEP to operate air pollution sources. Jet engine testing currently involves JP-8 fueled jet engines while rocket engine testing is currently only on liquid oxygen (LOX) and liquid hydrogen fueled rocket engines.

The project site, shown in Figures 2-1 and 2-2, consists of a portion of the 7,000-acre site that includes the Pratt & Whitney and Sikorsky. The project elevation will be approximately 5 ft above sea level. The terrain surrounding the site is flat.

Pratt & Whitney is proposing to construct a test cell that will be used for testing rocket engines that use LOX and kerosene propellants. The test cell will consists of the following systems:

- LOX and kerosene (RP1) supply tanks and distribution systems
- Engine containment can,
- Water cooled silencer,
- Exhaust gas deflector,
- Lined cooling water retention pond, and
- Elevated 1-million-gallon water supply tank.

Engines that will be tested will be situated inside the engine containment can. Fuel consisting of LOX and kerosene will be supplied to the engine from a 64,000-gallon LOX tank and a 36,000-gallon kerosene tank. The temperature and pressure of the LOX and kerosene must be able to operate within the range described below during the start and run of the test.

LOX Propellant

The inlet temperature of the LOX will be controlled through propellant conditioning and the inlet pressure of LOX will be dropped to a minimum of 40 pounds per square inch atmospheric (psia) during the run of the test.

Kerosene (RP1) Propellants

The inlet temperature of the kerosene (RP1) will be controlled through propellant conditioning. The kerosene consumption will be 1667 lbm during the start of the test with a maximum flow of 741.1 lbm/sec.

Once the engine starts, the exhaust is directed through the 20-ft diameter water-cooled silencer. The silencer is designed in a way to allow ambient air into the air stream to provide sufficient oxygen for complete combustion in case unburned fuel is present. Water from the elevated reservoir is pumped into the silencer cooling water jacket and injected into the gas stream to cool the gases and to aid in silencing. Water is used a at a rate of 200,000 gallon per minute to cool the 6,000 °F exhaust gases. The gases are diverted upward using a deflector (see Figure 2-3) to avoid vegetation impacts. Unevaporated water in the silencer is directed to the retention pond where the water is analyzed. If the water is free of unburned fuel oil it is pumped into the elevated tank and re-used. If the water is contaminated, skimmers will be utilized to remove unburned fuel oils. Make-up water will be added to the elevated tank as needed.

2.2 CURRENT AIR EMISSIONS

The existing Pratt & Whitney facility consists of the manufacturing, testing and the Sikorsky helicopter areas. Both Pratt & Whitney and Sikorsky have received permits from Florida DEP to operate air pollution sources. The permit numbers for Pratt & Whitney and Sikorsky are: 099-0021-002-AV and 009-0815-001-AF, respectively. These permits were issued on January 6, 1999 and March 13, 1997 for Pratt & Whitney and Sikorsky and will expire on January 5, 2004 and March 2002.

The permitted pollution sources at the Pratt & Whitney facility consists of:

- 1 air compressors,
- 7 air heaters,
- 5 Small Boilers,
- 3 Vapor degreaser,
- 1 solvent still,
- 21 diesel storage tanks,
- 18 jet propulsion fuel storage tanks,
- 3gasoline storage tanks,
- 5 spray booth,
- 2 acid scrubbers,
- 2 furnaces,
- 1 evaporator, and
- 2 dust collectors.

The permitted sources at Sikorsky include:

- 3 spray booths, and
- 1 downdraft work table with dust collector.

Based on information presented in the Title V permit application, the sources covered by these permits with an emission limited pollutant have a potential to emit the following amounts of pollutants:

Pollutant	Amount (tons/yr)
SO_2	505.2
NO_x	2,342

Actual emissions for the site, in tons/year, have been:

Pollutant	1998	1999
SO_2	14.2	9.8
NO_x	204.2	84.2

The above-referenced emissions indicate that Pratt & Whitney is a major source facility.

2.3 FUTURE MAXIMUM AIR EMISSIONS

The estimated maximum emissions and exhaust information for the rocket test cell is based on a LOX to fuel mix ratio of 2.72, a test run duration of 240 seconds, and 12 tests per year. The combustion process is expected to produce CO and trace amounts of SO_2 and nitrogen oxide (NO_x). Pratt & Whitney propose to monitor and maintain records of fuel use to demonstrate compliance.

The exhaust constituents at 105% power without afterburning and at a 2.72 fuel mixture ration are as follows:

Pollutant	Flow (lbm/sec)	Flow (kg/sec)
CO	694.4	315.0
CO_2	1366.0	619.6
H	0.035	0.016
H_2	17.12	7.765
H_2O	823.3	373.4
O	0.0	0.0
OH	0.293	0.133
O_2	0.003	0.001
SO_x	<1	<1
NO_x	Trace	Trace

Source: Pratt & Whitney 1999

Based on a 2.72 fuel mixture, the emission rates presented above, and 12 test runs per year, the maximum potential annual emissions for the proposed facility for the regulated air pollutant CO is 1,000 tons per year (TPY) or 83.3 tons per tests run.

As discussed in Section 6.0, the air modeling analyses that addressed compliance with ambient standards were based on modeling the rocket tests in the mode, which produced the maximum impacts.

2.4 SITE LAYOUT, STRUCTURES, AND STACK SAMPLING FACILITIES

A plot plan of the proposed facility is presented in Figure 2-2. The dimensions of the buildings and structures are presented in Section 6.0.

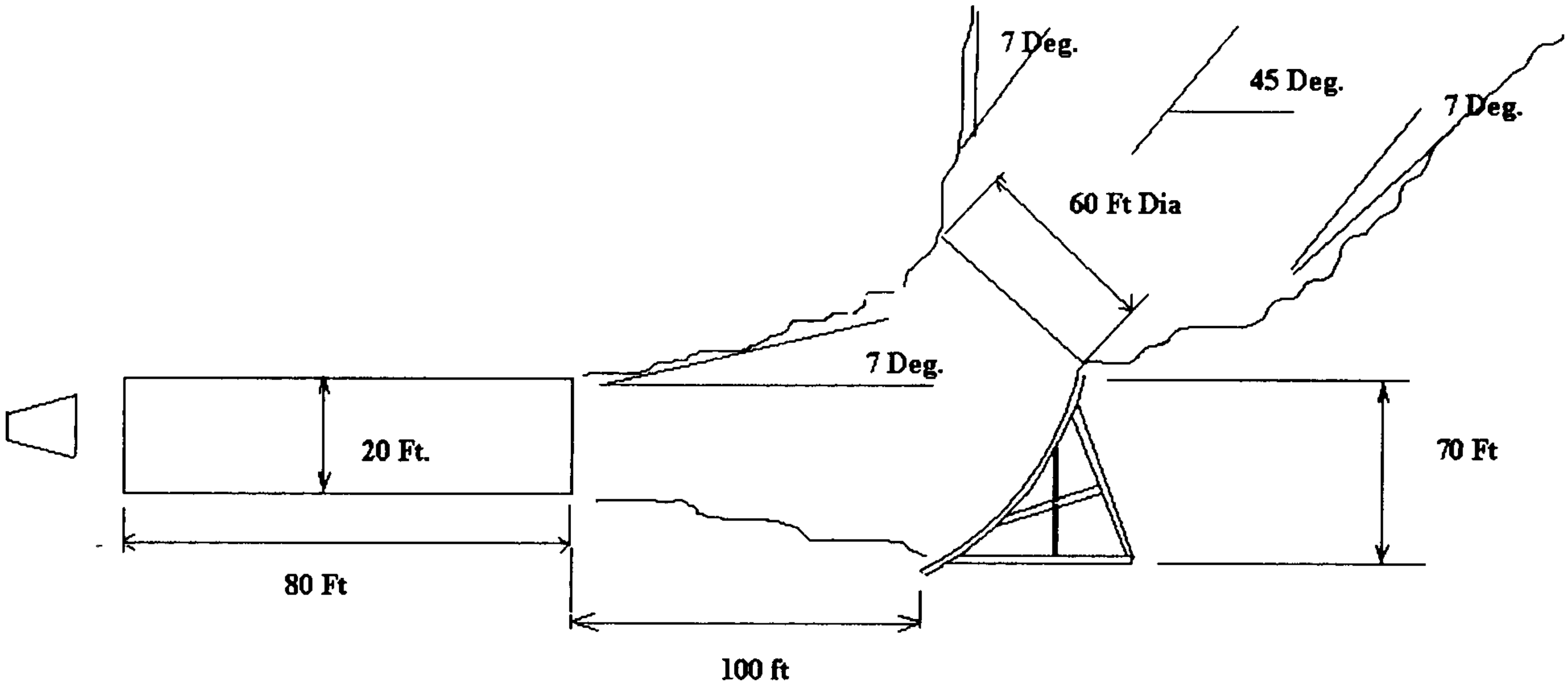

Figure 2-3
Simplified LOX/Kerosene Rocket Engine StandSchematic

Source: Pratt & Whitney, 2000

Golder Associates

3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

The following discussion pertains to the federal and state air regulatory requirements and their applicability to the proposed project.

3.1 NATIONAL AND STATE AAQS

The existing national and Florida AAQS are presented in Table 3-1. Primary AAQS were promulgated to protect the public health with an adequate margin of safety [42 United States Code (USC) Section 7409(b)(1)]. The primary AAQS are designed to protect children, the elderly, and those with respiratory diseases. Secondary AAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air [42 USC Section 7409(b)(2)]. Areas of the country in violation of AAQS are designated as nonattainment areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements.

3.2 PSD REQUIREMENTS

3.2.1 GENERAL REQUIREMENTS

Federal PSD requirements are contained in the CFR, Title 40, Part 52.21, and PSD of air quality. The state of Florida has adopted PSD regulations (Rule 62-212.400) that are essentially identical to the federal regulations. Florida's State Implementation Plan (SIP), which contains PSD regulations, has been approved by EPA; therefore, PSD approval authority has been granted to DEP.

PSD regulations require that all new major stationary facilities or major modifications to existing major facilities which emits air pollutants regulated under Clean Air Act (CAA) must be reviewed and a permit issued before the commencement of construction.

A "major facility" is defined as any one of 28 named source categories that have the potential to emit 100 TPY or more, or any other stationary facility that has the potential to emit 250 TPY or more, of any pollutant regulated under CAA. "Potential to emit" means the capability, at maximum design capacity, to emit a pollutant after the application of control equipment.

Subject to certain exceptions, a "major modification" is defined under PSD regulations as a physical or operational change at an existing major facility that increases the facility's emissions by an amount that is greater than the defined significant emission rates. PSD significant emission rates are shown in Table 3-2.

EPA's regulations identify certain increases above an air quality baseline concentration level of SO_2, PM_{10}, and NO_2 concentrations that would constitute significant deterioration. The EPA class designations and allowable PSD increments are presented in Table 3-1. The State of Florida has adopted the EPA class designations and allowable PSD increments for SO_2, PM_{10}, and NO_2 increments.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified facility. Federal PSD requirements are contained in 40 CFR 52.21, *Prevention of Significant Deterioration of Air Quality*. The State of Florida has adopted PSD regulations which have been approved by EPA [Rule 62-212.400 F.A.C.]. Major facilities and major modifications are required to undergo the following analysis related to PSD for each pollutant emitted in significant amounts:

1. Control technology review,
2. Source impact analysis,
3. Air quality analysis (monitoring),
4. Source information, and
5. Additional impact analyses.

In addition to these analyses, a new facility also must be reviewed with respect to GEP stack height regulations. Discussions concerning each of these requirements are presented in the following sections.

3.2.2 CONTROL TECHNOLOGY REVIEW

The control technology review requirements of the federal and state PSD regulations require that all applicable federal and state emission-limiting standards be met, and that BACT be applied to control emissions from the source (Rule 62-212.410, F.A.C.). The BACT requirements are applicable to all regulated pollutants for which the increase in emissions from the facility or modification exceeds the significant emission rate (see Table 3-2).

BACT is defined in 52.21 (b)(12) and Rule 62-210.200(40), F.A.C., as:

> An emissions limitation (including a visible emission standard) based on the maximum degree of reduction of each pollutant subject to regulation under the Act which would be emitted by any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60 and 61. If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular part of a source or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reductions achievable by implementation of such design, equipment, work practice, or operation and shall provide for compliance by means which achieve equivalent results.

BACT was promulgated within the framework of the PSD requirements in the 1977 amendments of the CAA [Public Law 95-95; Part C, Section 165(a)(4)]. The primary purpose of BACT is to optimize consumption of PSD air quality increments and thereby enlarge the potential for future economic growth without significantly degrading air quality (EPA, 1978; 1980). Guidelines for the evaluation of BACT can be found in EPA's *Guidelines for Determining Best Available Control Technology (BACT)* (EPA, 1978) and in the *PSD Workshop Manual* (EPA, 1980). These guidelines were promulgated by EPA to provide a consistent approach to BACT and to ensure that the impacts of alternative emission control systems are measured by the same set of parameters. In addition, through implementation of these guidelines, BACT in one area may not be identical to BACT in another area. According to EPA (1980), "BACT analyses for the same types of emissions unit and the same pollutants in different locations or situations may determine that different control strategies should be applied to the different sites, depending on site-specific factors. Therefore, BACT analyses must be conducted on a case-by-case basis."

The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the proposed facility. BACT must, as a minimum, demonstrate compliance with New Source Performance Standards (NSPS) for a source (if applicable). An evaluation of the air pollution control techniques and systems, including a cost-benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems, as well as the environmental benefits derived from these systems. A decision on BACT is to be based on sound judgment, balancing environmental benefits with energy, economic, and other impacts (EPA, 1978).

Historically, a "bottom-up" approach consistent with the BACT Guidelines and PSD Workshop Manual has been used. With this approach, an initial control level, which is usually NSPS, is evaluated against successively more stringent controls until a BACT level is selected. However, EPA became concerned that the bottom-up approach was not providing the level of BACT decisions originally intended. As a result, in December 1987, the EPA Assistant Administrator for Air and Radiation mandated changes in the implementation of the PSD program, including the adoption of a new "top-down" approach to BACT decision making.

The top-down BACT approach essentially starts with the most stringent (or top) technology and emissions limit that have been applied elsewhere to the same or a similar source category. The applicant must next provide a basis for rejecting this technology in favor of the next most stringent technology or propose to use it. Rejection of control alternatives may be based on technical or economic infeasibility. Such decisions are made on the basis of physical differences (e.g., fuel type), locational differences (e.g., availability of water), or significant differences that may exist in the environmental, economic, or energy impacts. The differences between the proposed facility and the facility on which the control technique was applied previously must be justified. EPA has issued a draft guidance document on the top-down approach entitled *Top-Down Best Available Control Technology Guidance Document* (EPA, 1990).

3.2.3 SOURCE IMPACT ANALYSIS

A source impact analysis must be performed for a proposed major source subject to PSD review for each pollutant for which the increase in emissions exceeds the significant emission rate (Table 3-2). The PSD regulations specifically provide for the use of atmospheric dispersion models in performing impact analyses, estimating baseline and future air quality levels, and determining compliance with AAQS and allowable PSD increments. Designated EPA models normally must be used in performing the impact analysis. Specific applications for other than EPA-approved models require EPA's consultation and prior approval.

Guidance for the use and application of dispersion models is presented in the EPA publication *Guideline on Air Quality Models (Revised)*. The source impact analysis for criteria pollutants that addresses compliance with AAQS and PSD Class II increments may be limited to the new or modified source if the net increase in impacts as a result of the new or modified source is below the significance levels, as presented in Table 3-1.

Various lengths of record for meteorological data can be used for impact analysis. A 5-year period can be used with corresponding evaluation of highest, second-highest short-term concentrations for comparison to AAQS or PSD increments. The term "HSH" refers to the highest of the second-highest concentrations at all receptors (i.e., the highest concentration at each receptor is discarded). The second-highest concentration is significant because short-term AAQS specify that the standard should not be exceeded at any location more than once a year. If fewer than 5 years of meteorological data are used in the modeling analysis, the highest concentration at each receptor normally must be used for comparison to air quality standards.

3.2.4 AIR QUALITY MONITORING REQUIREMENTS

In accordance with requirements of 40 CFR 52.21(m) and Rule 62-212.400(5)(f), F.A.C., any application for a PSD permit must contain an analysis of continuous ambient air quality data in the area affected by the proposed major stationary facility or major modification. For a new major facility, the affected pollutants are those that the facility potentially would emit in significant amounts. For a major modification, the pollutants are those for which the net emissions increase exceeds the significant emission rate (see Table 3-2).

Ambient air monitoring for a period of up to 1 year generally is appropriate to satisfy the PSD monitoring requirements. A minimum of 4 months of data is required. Existing data from the vicinity of the proposed source may be used if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered. Guidance in designing a PSD monitoring network is provided in EPA's *Ambient Monitoring Guidelines for Prevention of Significant Deterioration* (EPA, 1987a).

The regulations include an exemption that excludes or limits the pollutants for which an air quality analysis must be conducted. This exemption states that Florida DEP exempts a proposed major stationary facility or major modification from the monitoring requirements with respect to a particular pollutant if the emissions increase of the pollutant from the facility or modification would cause, in any area, air quality impacts less than the *de minimis* levels presented in Table 3-2 (Rule 62-212.400-3, F.A.C.).

3.2.5 SOURCE INFORMATION/GEP STACK HEIGHT

Source information must be provided to adequately describe the proposed project. The general type of information required for this project is presented in Section 2.0.

The 1977 CAA Amendments require that the degree of emission limitation required for control of any pollutant not be affected by a stack height that exceeds GEP or any other dispersion technique. On July 8, 1985, EPA promulgated final stack height regulations (EPA, 1985a). Identical regulations have been adopted by Florida DEP (Rule 62-210.550, F.A.C.). GEP stack height is defined as the highest of:

1. 65 m; or
2. A height established by applying the formula:

   $Hg = H + 1.5L$

   where: Hg = GEP stack height,

   H = Height of the structure or nearby structure, and

   L = Lesser dimension (height or projected width) of nearby structure(s); or
3. A height demonstrated by a fluid model or field study.

"Nearby" is defined as a distance up to five times the lesser of the height or width dimensions of a structure or terrain feature, but not greater than 0.8 kilometer (km). Although GEP stack height regulations require that the stack height used in modeling for determining compliance with AAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater.

The stack height regulations also allow increased GEP stack height beyond that resulting from the above formula in cases where plume impaction occurs. Plume impaction is defined as concentrations measured or predicted to occur when the plume interacts with elevated terrain. Elevated terrain is defined as terrain that exceeds the height calculated by the GEP stack height formula.

3.2.6 ADDITIONAL IMPACT ANALYSIS

In addition to air quality impact analyses, federal and State of Florida PSD regulations require analyses of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of the proposed source [40 CFR 52.21(o); Rule 62-212.400(5)(e), F.A.C.]. These analyses are to be conducted primarily for PSD Class I areas. Impacts as a result of general commercial, residential, industrial, and other growth associated with the source also must be addressed. These analyses are required for each pollutant emitted in significant amounts (see Table 3-2).

3.3 NONATTAINMENT RULES

Based on the current nonattainment provisions (Rule 62-212.500, F.A.C.), all major new facilities and modifications to existing major facilities located in a nonattainment area must undergo nonattainment review. A new major facility is required to undergo this review if the proposed pieces of equipment have the potential to emit 100 TPY or more of the nonattainment pollutant. A major modification at a major facility is required to undergo review if it results in a significant net emission increase of 40 TPY or more of the nonattainment pollutant or if the modification is major (i.e., 100 TPY or more).

For major facilities or major modifications that locate in an attainment or unclassifiable area, the nonattainment review procedures apply if the source or modification is located within the area of influence of a nonattainment area. The area of influence is defined as an area that is outside the boundary of a nonattainment area but within the locus of all points that are 50 km outside the boundary of the nonattainment area. Based on Rule 62-2.500(2)(c)2.a., F.A.C., all VOC sources that are located within an area of influence are exempt from the provisions of NSR for nonattainment areas. Sources that emit other nonattainment pollutants and are located within the area of influence are subject to nonattainment review unless the maximum allowable emissions from the proposed source do not have a significant impact within the nonattainment area.

3.4 EMISSION STANDARDS

3.4.1 NEW SOURCE PERFORMANCE STANDARDS

The NSPS are a set of national emission standards that apply to specific categories of new sources. As stated in the CAA Amendments of 1977, these standards "shall reflect the degree of emission limitation and the percentage reduction achievable through application of the best technological system of continuous emission reduction the Administrator determines has been adequately demonstrated."

The proposed project will not be subject to NSPS. The proposed 36,000-gallon kerosene tank is exempt from 40 CFR Part 60, Subpart Kb.

3.4.2 FLORIDA AIR PERMITTING REQUIREMENTS

The Florida DEP regulations require any new source to obtain an air permit prior to construction. Major new sources must meet the appropriate PSD and nonattainment requirements as discussed previously. Required permits and approvals for air pollution sources include NSR for nonattainment areas, PSD, NSPS, National Emission Standards for Hazardous Air Pollutants (NESHAP), Permit to Construct, and Permit to Operate. The requirements for construction permits and approvals are contained in Rules 62-4.030, 62-4.050, 62-4.052, 62-4.210, and 62-210.300(1), F.A.C. Specific emission standards are set forth in Chapter 62-296, F.A.C.

3.4.3 LOCAL AIR REGULATIONS

Palm Beach County has not adopted its own air regulations.

3.5 SOURCE APPLICABILITY

3.5.1 AREA CLASSIFICATION

The project site is located in Palm Beach County, which has been designated by EPA and DEP as an attainment area for all criteria pollutants. Palm Beach County and surrounding counties are designated as PSD Class II areas for SO_2, particulate matter (PM) [total suspended particulate matter (TSP)], and NO_2. The nearest Class I areas to the site is the Everglades National Park (NP) which is about 120km (74.9 miles) from the site.

3.5.2 PSD REVIEW

3.5.2.1 Pollutant Applicability

The proposed project is considered to be a modification of a major facility because the potential emissions exceed the PSD major threshold and that potential emissions from at least one regulated pollutant emitted by the new project is estimated to exceed the TPY significant emission rate. Therefore, PSD review is required for each pollutant for which the emissions are considered major or exceed the PSD significant emission rates. As shown in Table 3-3, potential emissions for CO exceed the PSD significant emission rate. Because the proposed project's impacts for this pollutant is predicted to be below the significant impact levels, a modeling analysis incorporating the impacts from other sources is not required.

As part of the PSD review, a PSD Class I increment analysis is required if the proposed project's impacts are greater than the proposed EPA Class I significant impact levels. The nearest Class I areas to the plant site is about 120 km from the site. A PSD Class I increment-consumption analysis is not required because the project's CO impacts have no designated applicable EPA Class I significant impact levels.

3.5.2.2 Ambient Monitoring

Based on the estimated pollutant emissions from the proposed project (see Table 3-4), a pre-construction ambient air quality monitoring analysis is required for CO. If the net increase in impact of the pollutant is less than the applicable *de minimis* monitoring concentration (575 TPY in the case of CO), then an exemption from the pre-construction ambient monitoring requirement may be obtained [52.21(i)(8)]. In addition, if an acceptable ambient monitoring method for the pollutant has not been established by EPA, monitoring is not required.

If pre-construction monitoring data are required to be submitted, data collected at or near the project site can be submitted, based on existing air quality data or the collection of onsite data.

As shown in Table 3-4, the proposed project's impacts are predicted to be above the applicable *de minimis* monitoring concentration levels and criteria. Therefore, the project is required to comply with the preconstruction ambient air quality monitoring requirements.

3.5.2.3 GEP Stack Height Impact Analysis

The GEP stack height regulations allow any stack to be at least 65 m [213 feet (ft)] high. The proposed test cell stack for the project will not exceed the GEP stack height. However, as discussed in Section 6.0, Air Quality Modeling Approach, since the stack height is less than GEP, building downwash effects must be considered in the modeling analysis. As a result, the potential for downwash of the test cell's emissions caused by nearby structures are included in the modeling analysis.

3.5.3 NONATTAINMENT REVIEW

The project site is located in Palm Beach County, which is classified as an attainment area for all criteria pollutants. Therefore, nonattainment requirements are not applicable.

Table 3-1. National and State AAQS, Allowable PSD Increments, and Significant Impact Levels

Pollutant	Averaging Time	AAQS ($\mu g/m^3$) Primary Standard	AAQS ($\mu g/m^3$) Secondary Standard	AAQS ($\mu g/m^3$) Florida	PSD Increments ($\mu g/m^3$) Class I	PSD Increments ($\mu g/m^3$) Class II	Significant Impact Levels ($\mu g/m^3$)[b]
Particulate Matter[c] (PM_{10})	Annual Arithmetic Mean	50	50	50	4	17	1
	24-Hour Maximum	150	150	150	8	30	5
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20	1
	24-Hour Maximum[a]	365	NA	260	5	91	5
	3-Hour Maximum[a]	NA	1,300	1,300	25	512	25
Carbon Monoxide	8-Hour Maximum[a]	10,000	10,000	10,000	NA	NA	500
	1-Hour Maximum[a]	40,000	40,000	40,000	NA	NA	2,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25	1
Ozone[c]	8-Hour Maximum[d]	157	157	157	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	1.5	NA	NA	NA

Note: Particulate matter (PM_{10}) = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.
NA = Not applicable, i.e., no standard exists.

[a] Short-term maximum concentrations are not to be exceeded more than once per year.

[b] Maximum concentrations are not to be exceeded.

[c] On July 18, 1997, EPA promulgated revised AAQS for PM and O_3. For particulate matter, $PM_{2.5}$ standards were introduced with a 24-hour standard of 65 g/m^3 (3-year average of 98[th] percentile) and an annual standard of 15 g/m^3 (3-year average at community monitors). These standards have been stayed by a court case against EPA; implementation of these standards appears to be years away.

[d] 0.08 parts per million (ppm); achieved when 3-year average of 99[th] percentile is 0.08 ppm or less. These have been stayed by a court case against EPA. EPA is appealing. The 1-hour standard of 0.12 ppm is still applicable. Florida DEP has not yet adopted the new standards.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978.; 40 CFR 50; 40 CFR 52.21.; Chapter 62-204, F.A.C.

Table 3-2. PSD Significant Emission Rates and *De Minimis* Monitoring Concentrations

Pollutant	Regulated Under	Significant Emission Rate (TPY)	*De Minimis* Monitoring Concentration[a] (μg/m3)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter [PM (TSP)]	NSPS	25	10, 24-hour
Particulate Matter (PM_{10})	NAAQS	15	10, 24-hour
Nitrogen Dioxide	NAAQS, NSPS	40	14, annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY[b]
Lead	NAAQS	0.6	0.1, 3-month
Sulfuric Acid Mist	NSPS	7	NM
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.2, 1-hour
Mercury	NESHAP	0.1	0.25, 24-hour
MWC Organics	NSPS	$3.5x10^{-6}$	NM
MWC Metals	NSPS	15	NM
MWC Acid Gases	NSPS	40	NM
MSW Landfill Gases	NSPS	50	NM

Note: Ambient monitoring requirements for any pollutant may be exempted if the impact of the increase in emissions is below *de minimis* monitoring concentrations.

NAAQS = National Ambient Air Quality Standards.
NM = No ambient measurement method established; therefore, no *de minimis* concentration has been established.
NSPS = New Source Performance Standards.
NESHAP = National Emission Standards for Hazardous Air Pollutants.
$\mu g/m^3$ = micrograms per cubic meter.
MWC = Municipal waste combustor
MSW = Municipal solid waste

[a] Short-term concentrations are not to be exceeded.
[b] No *de minimis* concentration; an increase in volatile organic compound (VOC) emissions of 100 TPY or more will require monitoring analysis for O_3.
[c] Any emission rate of these pollutants.

Sources: 40 CFR 52.21.
Rule 62-212.400

Table 3-3. Maximum Emissions Due to the Proposed LOX/Kerosene Rocket Engine Stand Compared to the PSD Significant Emission Rates

Pollutant	Pollutant Emissions (TPY)		PSD Review
	Potential Emissions from Proposed Facility	Significant Emission Rate	
Sulfur Dioxide	NEG	40	No
Particulate Matter [PM (TSP)]	NEG	25	No
Particulate Matter (PM_{10})	NEG	15	No
Nitrogen Dioxide	NEG	40	No
Carbon Monoxide	1,000	100	Yes
Volatile Organic Compounds	NEG	40	No

Note: NEG = Negligible.

Table 3-4. Predicted Net Increase in Impacts Due to the Proposed LOX/Kerosene Rocket Engine Stand Project Compared to PSD *De Minimis* Monitoring Concentrations

Pollutant	Concentration ($\mu g/m^3$)	
	Predicted Increase in Impacts[a]	*De Minimis* Monitoring Concentration; Averaging Period
Sulfur Dioxide	NEG	13; 24-hour
Particulate Matter (PM_{10})	NEG	10; 24-hour
Nitrogen Dioxide	NEG	14; annual
Carbon Monoxide	627	575; 8-hour
Ozone	NEG	100 tons/year of VOCs

Note: NA = not applicable.
NM = no ambient measurement method.
TPY = tons per year.
NEG = negligible

4.0 CONTROL TECHNOLOGY REVIEW

4.1 APPLICABILITY

The PSD regulations require new major stationary sources to undergo a control technology review for each pollutant that may potentially be emitted in amounts that are greater than the PSD significant emission rates shown in Table 3-2. In this case, the control technology review requirements of the PSD regulations are applicable to emissions of CO (see Section 3.0). The maximum potential annual emissions for CO is 1,000 TPY.

This section presents the applicable NSPS and the proposed BACT for this pollutant. The approach to the BACT analysis is based on the regulatory definitions of BACT, as well as EPA's current policy guidelines requiring a top-down approach. A BACT determination requires an analysis of the economic, environmental, and energy impacts of the proposed and alternative control technologies [see 40 CFR 52.21(b)(12); and Rule 62-210.200(42), and Rule 62-214.410, F.A.C.]. The analysis must, by definition, be specific to the project (i.e., case-by-case).

4.2 NEW SOURCE PERFORMANCE STANDARDS

No applicable NSPS for exists for rocket testing

4.3 BEST AVAILABLE CONTROL TECHNOLOGY

Emissions of CO are dependent upon the combustion design, which is a result of the operating specifications, including the air-to-fuel ratio, staging of combustion, and the amount of water injected. Where possible, such pollution prevention controls, such as combustion controls are preferred since they can be both cost effective and eliminate other environmental and energy impacts of add-on controls. Additionally to control the CO emissions effectively the emissions must be captured. This will be difficult with the large size and thrust of the exhaust stream.

The rockets to be tested in the proposed test cell have designs to optimize combustion efficiency and minimize CO by the introduction of air to the combustion process. The silencer has been designed with open ports around the silencer near the rocket test cell. The test burns will also be limited to 240 seconds which should also minimized the amount of CO emissions.

4.3.1 PROPOSED BACT AND RATIONALE

Combustion design is proposed as BACT, as there are adverse technical and economic consequences of using control on the emissions from 1 million lb thrust of the LOX/kerosene rocket engine stand. The proposed BACT emission rates for CO will be controlled by introducing and controlling the air-fuel ratio to allow for efficient combustion. Control is considered unreasonable for the following reasons:

1. Control is not feasible due to the short duration of the tests, the exhaust temperature, and the volume flow rate. Control has never been preformed on this scale which has flow rates approaching 3 to 4 times the size of the largest combustion turbine.
2. Hypothetically if control could be achieved, the economic impacts would be significant. A massive infrastructure would be required to capture the exhaust stream from the rocket and the control device would be required to withstand a maximum thrust force of 1 million pounds of force and high temperatures. The capital cost to construct the infrastructure is estimated at about 100 million,
3. Hypothetical if one could be install a control device such as an incinerator, the capital cost for a conventional incinerator would be about $579 million with an annualized cost of $68 million.

Combustion design is proposed as BACT as a result of the technical and economic consequences of control equipment on a rocket exhaust are not feasible.

The air quality impacts from the LOX/kerosene rocket engine stand are slightly above the significant impact levels for CO but well below the applicable AAQS. The maximum CO impacts are less than 0.05 percent of the applicable AAQS for each test run. Therefore, no significant environmental benefit would be realized by the installation of CO control equipment. There would also be no secondary benefits, such as reductions in acidic deposition, to reducing CO.

The evaluation clearly indicates that the use of control equipment is not cost effective and is inappropriate as BACT. The control of the CO emissions from the entire 1 million lb thrust of the LOX/kerosene rocket engine stand is considered unfeasible from the ability to construct control equipment capable to withstand the temperature and thrust.

Moreover, the uncertainty associated with CO capture for such a large exhaust stream with a large thrust force suggests that such an option is unreasonable as BACT. Indeed, no rocket test exhaust of this scale has been required in any state to meet a BACT requirement with the cost and uncertainties associated with control emissions from the firing of the test rockets. The add-on control options are rejected as BACT.

Economic and energy considerations were not addressed due to the unfeasible nature of providing control equipment as described above.

5.0 AMBIENT MONITORING ANALYSIS

The CAA requires that an air quality analysis be conducted for each criteria and noncriteria pollutant subject to regulation under the Act before a major stationary source is constructed. Criteria pollutants are those pollutants for which AAQS have been established. Noncriteria pollutants are those pollutants that may be regulated by emission standards, but no AAQS have been established. This analysis may be performed by the use of modeling and/or by monitoring the air quality.

The project's maximum impacts are compared to *de minimis* air monitoring levels to determine whether it would be necessary to submit continuous monitoring data to DEP prior to construction. For all applicable pollutants that have emission increases that will exceed the PSD significant emission rate due for a proposed project, a *de minimis* impact analysis is performed to determine whether the project's maximum predicted impacts alone will exceed the EPA *de minimis* levels at any off-plant property areas in the vicinity of the plant. Current Florida DEP policies stipulate that the highest annual average and highest short-term concentrations are to be compared to the applicable *de minimis* monitoring levels.

A proposed major stationary facility or major modification may be exempt from the monitoring requirements with respect to a particular pollutant if the emissions increase of the pollutant from the facility or modification would result in maximum air quality impacts below the *de minimis* levels.

For this project, the proposed project's maximum CO impacts were calculated in the vicinity of the plant for comparison to *de minimis* levels following Florida DEP policies. The maximum predicted 8-hour CO concentration of 627 $\mu g/m^3$ is greater then the CO *de minimis* concentration of 575 $\mu g/m^3$. Therefore, the project is subject to preconstruction ambient monitoring requirements.

A major source can waive the ambient monitoring analysis requirement if existing ambient air quality data representative of the project site location can be used in lieu of the air monitoring requirement. For this analysis, existing CO air monitoring data collected from West Palm Beach are provided to satisfy this requirement. The CO monitoring data are summarized in Table 5-1. Based on these data, the highest, second-highest measured 1-hour and 8-hour concentrations were selected as background concentrations. These concentrations are 5.6 part per million (6,440 $\mu g/m^3$) and 3.0 ppm (3,450 $\mu g/m^3$), respectively, for the 1-hour and 8-hour averaging times. These background concentrations were added to the modeled HSH concentrations to estimate total air quality for comparison to AAQS.

Table 5-1. Summary of CO Ambient Monitoring Data from West Palm Beach

Year	County	Station ID	Monitor Location	Number of Observations	Concentration (ppm) Maximum 1-Hour	2nd-High 1-Hour	Maximum 8-Hour	2nd-High 8-Hour
1998	Palm Beach	12-099-1004	Belevedere Road	8,280	6.0	**5.6**	2.7	2.5
1999	Palm Beach	12-099-1004	Belevedere Road	4,073	4.2	3.6	2.6	2.1
1998	Palm Beach	12-009-1006	S. Military Trail	8,476	5.4	5.3	3.0	**3.0**
1999	Palm Beach	12-009-1006	S. Military Trail	4,262	5.5	5.2	2.3	2.3

Note: Concentrations in bold are selected as background for the AAQS analysis
ppm = parts per million.
1 ppm = 1,150 micrograms per cubic meter ($\mu g/m^3$)

6.0 AIR QUALITY IMPACT ANALYSIS

6.1 GENERAL MODELING APPROACH

The general modeling approach followed EPA and Florida DEP modeling guidelines for determining compliance with AAQS and PSD increments. For all applicable pollutants whose emission's increase exceed the PSD significant emission rate, a significant impact analysis is performed to determine whether the project alone will result in predicted impacts that will exceed the EPA significant impact levels at any off-plant property areas in the vicinity of the plant.

If the project's impacts are above the significant impact levels, then a more detailed air modeling analysis that includes background sources is performed. Current Florida DEP policies stipulate that the highest annual average and highest short-term (i.e., 24 hours or less) concentrations are to be compared to the applicable significant impact levels. Based on the screening analysis modeling results, refinements are generally performed in the vicinity of the maximum concentration from the screening analysis. The refinements are performed with denser receptor grid to obtain the maximum concentrations with a receptor grid spacing of 100 meters (m) or less.

Because the proposed project's emissions will exceed the EPA significant emission rate for only CO, a significant impacts analysis was performed for that pollutant in the vicinity of the project site following Florida DEP policies.

Generally, if a project also is within 150-200 km of a PSD Class I area, then a significant impact analysis is also performed for that PSD Class I area. However, because allowable PSD increments have not been promulgated for CO, a PSD Class I significant impact analysis is not required.

6.1.1 SIGNIFICANT IMPACT ANALYSIS

'or each pollutant that is emitted by the project in amounts greater than the EPA significant ission rate, a significant impact analysis is required to determine if the maximum licted impacts from the proposed project alone are greater then the significant impact ev and the *de minimis* monitoring levels. The maximum concentrations are predicted using 5 years of hourly meteorological data and by selecting the highest annual and the highest short-term concentrations for comparison to the significant impact levels and the *de minimis* levels.

6.1.2 AAQS ANALYSIS

If the project's impacts are greater than the significant impact levels, the air modeling analyses must consider other nearby sources and background concentrations, and calculate the cumulative impact of these sources for comparison to ambient standards. In general, when 5 years of meteorological data are used in the analysis, the highest annual and the highest, second-highest (HSH) concentrations are compared to the applicable AAQS. The HSH concentration is calculated for a receptor field by:

1. Eliminating the highest concentration predicted at each receptor,
2. Identifying the second-highest concentration at each receptor, and
3. Selecting the highest concentration among these second-highest concentrations.

This approach is consistent with the method used to determine compliance with AAQS and allowable PSD increments, which permit a short-term average concentration to be exceeded once per year at each receptor.

An air quality modeling analysis was performed to determine if the CO emissions released during a 240-second test burn of a LOX/kerosene rocket engine stand would comply with the AAQS. CO has two AAQS: an 8-hour averaging time standard of 10,000 $\mu g/m^3$ and a 1-hour averaging time standard of 40,000 $\mu g/m^3$. Compliance with both the 8-hour and 1-hour AAQS was evaluated in this study.

To develop the maximum short-term concentrations for the proposed project, the modeling approach was divided into screening and refined phases to reduce the computation time required to perform the modeling analysis. For this study, the only difference between the two modeling phases is the density of the receptor grid spacing employed when predicting concentrations. A screening receptor grid is a coarse resolution receptor grid that covers a wide area in the vicinity of the project site. Once all areas of maximum concentrations are identified on the screening grid, one or more refined receptor grids are placed over the area(s) of the predicted maximum screening grid concentration(s) to obtain a refined maximum concentration that is compared to the AAQS. Concentrations are predicted for the screening phase using a coarse receptor grid and a 5-year meteorological data record.

Refinements of the maximum predicted concentrations from the screening grid are typically performed in the vicinity of the receptors of the screening receptor grid that produced the HSH concentrations over the 5-year period. However, if other second-highest concentrations from other years in the screening analysis are within 10 percent of the HSH concentration, those other concentrations are also refined as well. The domain of the refined receptor grid typically extends to all adjacent screening receptors surrounding the screening receptor with the maximum predicted concentration. The air dispersion model is then executed with the refined grid for the entire year of meteorology during which the screening concentration occurred. This approach is used to ensure that a valid HSH concentration is obtained. A more detailed description of the model used, along with the emission inventory, meteorological data, and screening receptor grids used in the analysis, are presented in the following sections.

6.1.3 MODEL SELECTION

The Industrial Source Complex Short-term (ISCST3, Version 99155) dispersion model (EPA, 1997) was used to evaluate the pollutant impacts due to the proposed LOX/kerosene rocket engine standproject. The model is maintained by the EPA on its internet website, Support Center for Regulatory Air Models (SCRAM), within the Technical Transfer Network (TTN). A listing of ISCST3 model features is presented in Table 6-1. The ISCST3 model is designed to calculate hourly concentrations based on hourly meteorological data (i.e., wind direction, wind speed, atmospheric stability, ambient temperature, and mixing heights). The ISCST3 model is applicable to sources located in either flat or rolling terrain where terrain heights do not exceed stack heights. These areas are referred to as simple terrain. The model can also be applied in areas where the terrain exceeds the stack heights. These areas are referred to as complex terrain.

Since the terrain within 50 km of the site can be described as simple, i.e., flat to gently rolling, a simple terrain model was selected to predict maximum ground-level concentrations.

In this analysis, the EPA regulatory default options were used to predict all maximum impacts. The ISCST3 model can run in the rural or urban land use mode which affects stability dispersion coefficients, wind speed profiles, and mixing heights. Land use can be characterized based on a scheme recommended by EPA (Auer, 1978). If more than 50 percent of the land use within a 3-km radius around a project is classified as industrial or commercial, or high-density residential, then the urban option should be selected. Otherwise, the rural option is appropriate. Based on the land-use within a 3-km radius of the Pratt & Whitney site are largely undeveloped lands(see Figure 2-1), the rural dispersion coefficients were used in the modeling analysis.

6.1.4 METEOROLOGICAL DATA

Meteorological data used in the ISCST3 model to determine CO air quality impacts consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper air soundings from the National Weather Service (NWS) station at the Palm Beach International Airport at West Palm Beach, Florida. The 5-year period of meteorological data was from 1987 through 1991. These data are the most recent 5-year period of meteorological data that have been approved by DEP for use in the modeling. The NWS station at West Palm Beach is located approximately 39 km (24 miles) southeast of the Pratt & Whitney site. The meteorological data from West Palm Beach are assumed to be representative of the project site because both the project site and the weather station are located in similar topographical areas and are situated in southern Florida to experience similar weather conditions, such as frontal passages.

The wind speed, cloud cover, and cloud ceiling values were used in the ISCST3 meteorological preprocessor program, PCRAMMET, to determine atmospheric stability using the Turner stability scheme. Based on the temperature measurements at morning and afternoon, mixing heights were calculated with the radiosonde data from PBI using the Holzworth approach (1972). Hourly mixing heights were derived from the morning and afternoon mixing heights using the interpolation method developed by EPA (Holzworth, 1972). The hourly surface data and mixing heights were used to develop a sequential series of hourly meteorological data for use in the ISCST3 model (i.e., wind direction, wind speed, temperature, stability, and mixing heights). Because the observed hourly wind directions were classified into one of 36 10-degree sectors, the wind directions were randomized within each 10-degree sector to account for the expected variability in air flow.

6.1.5 SOURCE INFORMATION

A schematic diagram of the engine's discharged CO emissions is presented in Figure 1. Upon discharge from the engine, the gases travel through a tube-shaped water-cooled silencer that is 100-ft long and has a diameter of 20 ft. The gases are then directed to an exhaust deflector that is located 100 ft beyond the end of the silencer. Upon leaving the top of the deflector, the gases are re-directed at a 45-degreee angle relative to the ground and are assumed contained within a 60-ft diameter circular area. The outer parts of this area are assumed deflected up to 7 degrees from the mean 45-degree discharge angle of the gases by air entrainment and frictional forces.

Although the engine emissions would be characterized as fugitive in nature, the CO emissions were simulated as a point source in the modeling to account for the emissions' exit temperature and exit velocity as well as the limited area of emission. The design of the point sources was based on the following additional information provided by Pratt & Whitney staff engineers.

1. The height of the top of the deflector is 70 ft. This height was assumed as the effective stack release height for the air modeling analysis.
2. The diameter of the exhaust gases was modeled as 60 ft, which is equal to the effective gas column diameter as it is leaving the top of the deflector.
3. The minimum speed and temperature of the exhaust gases leaving the deflector are estimated to be 65 feet per second (ft/sec), and 230°F (at ambient pressure), respectively. The velocity is calculated by assuming a density of 0.05 pound-mass per cubic feet, based on the gas stream comprised of steam that is used for cooling and the engine exhaust, the latter of which is comprised of mostly kerosene and oxygen.

4. Because the ISCST3 model does not account for non-vertical stacks, the vertical component of the exit gas was determined based on the lowest discharge angle. For the modeling analysis, a reduced velocity was used that is equal to the full speed times a factor of 0.616 (i.e., the sine of 38 degrees). This represents the vertical component of the angled velocity, calculated at the lowest mean discharge angle (45 minus 7 degrees) of the gas stream as it leaves the top of the deflector.

CO emissions were calculated based on a maximum power level of 100 percent for 240 seconds. The maximum emission rate is 694.4 pounds CO per second or approximately 83.2 tons CO per test. A maximum hourly emission rate was determined by dividing the total emissions from a test over an hour. A summary of the modeled emission rates and stack parameters used in the air modeling analysis is presented in Table 6-2.

6.1.6 RECEPTOR LOCATIONS

Concentrations were predicted at receptors located on and beyond Pratt & Whitney's restricted property boundary. To estimate maximum CO concentrations due to the project, a screening receptor grid comprised of 956 receptors in polar coordinates was used. The screening receptor grid considered of 740 receptors on 180 radials, spaced at 2-degree intervals, extending from the jet engine discharge location, which was selected as the origin of the grid for the air modeling analysis. Along each radial, receptors were located at the site property boundary and at offsite distances of 1.0, 1.5, 2.0, 2.5, and 3.0 km. An additional 216 receptors were located along 36 radials, spaced at 10-degree intervals, at distances of 10.0, 15.0, 20.0, 25.0 and 30.0 km from the engine discharge location.

Refinements were performed, as necessary, by using an interval angle between radials of 1.0 to 2.0 degrees in the vicinity of the maximum high or HSH concentrations produced by the screening analysis. Along each radial, receptions are located 100 m apart up to and including the adjacent screening grid receptors. The refined interval angle was selected, so that refined receptor spacing at the maximum concentrations would be no greater then 100 m.

6.1.7 BACKGROUND CONCENTRATIONS

To estimate total CO air quality concentrations for the AAQS analysis, both 8-hour and 1-hour background concentrations were added to the maximum HSH modeling results. The background concentration is considered to be the air quality concentration contributed by sources not included in the modeling evaluation. Because of the very brief and intermittent nature of the project emissions, background facilities with continuous emission were not included in the modeling analysis. Instead, a conservative background concentration from West Palm Beach was selected to represent the maximum air quality impacts due to non-modeled sources in the area of the project location.

A summary of the air quality data and selected background concentrations is presented in Section 5.0.

6.1.8 BUILDING DOWNWASH EFFECTS

The engine test burn is conducted in a area of the Pratt & Whitney site that is clear of building structures and other obstructions. Because there are no building structures in the vicinity of the engine test burn, building downwash effects on the test emissions are not likely to occur and were not accounted for in the air modeling

6.2 AIR MODELING RESULTS

6.2.1 SIGNIFICANT IMPACT ANALYSIS

A summary of the maximum predicted 8-hour and 1-hour CO concentrations due to the proposed project only is presented in Table 6-3. Because there are no emissions for the 7 hours after the test hour, the 8-hour averaged concentrations were set equal to the peak 1-hour concentrations divided by eight. Based on the screening results, modeling refinements were performed. The results of the refined modeling analyses are summarized in Table 6-4. The maximum predicted 8-hour and 1-hour CO concentrations are 627 and 5,012 $\mu g/m^3$, respectively, which are above the significant impact levels of 500 and 2,000 $\mu g/m^3$, respectively. Therefore, an AAQS analysis was performed.

6.2.2 AAQS ANALYSIS

Because the proposed project's emissions only last for 240 seconds, other background facilities with continuous emissions were not included in the air modeling analysis. Instead, conservative CO background concentrations measured in West Palm Beach were added to the modeled HSH 8-hour and 1-hour CO concentrations to produce the total CO air quality concentrations. A summary of the maximum predicted 8-hour and 1-hour CO concentrations due to all sources is presented in table 6-5. The total CO concentrations are 3,928 and 10,262 $\mu g/m^3$. These concentrations are 39 and 26 percent of the AAQS of 10,000 and 40,000 $\mu g/m^3$, respectively. Based on the air modeling results, it is concluded that the 240-second engine test burn will result in compliance of the AAQS.

Table 6-1. Major Features of the ISCST3 Model, Version 99155

ISCST3 Model Features
• Polar or Cartesian coordinate systems for receptor locations
• Rural or one of three urban options which affect wind speed profile exponent, dispersion rates, and mixing height calculations
• Plume rise due to momentum and buoyancy as a function of downwind distance for stack emissions (Briggs, 1969, 1971, 1972, and 1975; Bowers, et al., 1979).
• Procedures suggested by Huber and Snyder (1976); Huber (1977); and Schulman and Scire (1980) for evaluating building wake effects
• Procedures suggested by Briggs (1974) for evaluating stack-tip downwash
• Separation of multiple emission sources
• Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations
• Capability of simulating point, line, volume, area, and open pit sources
• Capability to calculate dry and wet deposition, including both gaseous and particulate precipitation scavenging for wet deposition
• Variation of wind speed with height (wind speed-profile exponent law)
• Concentration estimates for 1-hour to annual average times
• Terrain-adjustment procedures for elevated terrain including a terrain truncation algorithm for ISCST3; a built-in algorithm for predicting concentrations in complex terrain
• Consideration of time-dependent exponential decay of pollutants
• The method of Pasquill (1976) to account for buoyancy-induced dispersion
• A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used)
• Procedure for calm-wind processing including setting wind speeds less than 1 meters per second(m/s) to 1 m/s.

Note: ISCST3 = Industrial Source Complex Short-Term.
Source: EPA, 1999.

Table 6-2. Summary of CO Emissions and Stack Parameters for Engine Test Burn

Emissions[a]		Release Height		Diameter		Velocity[b]		Temperature	
(lb/hr)	(g/s)	(ft)	(m)	(ft)	(m)	(fps)	(m/s)	(°F)	(°K)
166656	20,999	70	21.3	60.00	18.3	40.0	12.20	230	383.2

[a] Based on 694.4 lb/sec for 240 seconds.

[b] Maximum 45-degree discharge velocity times sine (38 degrees).

Table 6-3. Predicted CO Impacts from Proposed Project - Screening Analysis

Averaging Time	Concentration[a] ($\mu g/m^3$)	Receptor Location[b]		Time Period (YYMMDDHH)
		Direction (degree)	Distance (m)	
High 8-Hour[c]				
	347	50	5454	87090711
	286	54	5557	88060411
	292	96	6246	89081511
	446	314	1395	90082412
	276	66	6076	91061913
HSH 8-Hour[c]				
	332	50	5454	87071211
	263	280	20000	88091101
	283	40	5322	89070311
	263	10	25000	90082119
	261	150	25000	91083007
High 1-Hour				
	2774	50	5454	87090711
	2288	54	5557	88060411
	2340	96	6246	89081511
	3565	314	1395	90082412
	2211	66	6076	91061913
HSH 1-Hour				
	2660	50	5454	87071211
	2102	280	20000	88091101
	2267	40	5322	89070311
	2106	10	25000	90082119
	2085	150	25000	91083007

[a] Based on 5-year meteorological record, West Palm Beach, 1987-91
[b] Relative to engine discharge location
[c] Because no test emissions occur for the additional 7 hours of the period, 8-hour concentrations are set equal to 1/8 of 1-hour concentrations.
YYMMDDHH = Year, Month, Day, Hour Ending
HSH = Highest, Second-Highest

Table 6-4. Maximum Predicted CO Impacts Due to the Proposed Project Only, Refined Analysis

Averaging Time	Concentration[a] ($\mu g/m^3$)	Receptor Location[b] Direction (degree)	Receptor Location[b] Distance (m)	Time Period (YYMMDDHH)	EPA Significant Impact Level ($\mu g/m^3$)	*de Minimis* Air Monitoring Concentration ($\mu g/m^3$)
High 8-Hour	627[c]	140	1,600	90082412	500	575
High 1-Hour	5,012	140	1,600	90082412	2,000	NA

[a] Based on highest predicted with 5-year meteorological record, West Palm Beach, 1987-91
[b] Relative to Engine Discharge Location
[c] Because no test emissions occur for the additional 7 hours of the period, set equal to 1/8 of 1-hour concentrations
YYMMDDHH = Year, Month, Day, Hour Ending

Table 6-5. Maximum Predicted CO Impacts Due to the Test Burn for Comparison to AAQS, Refined Analysis

Averaging Time	Concentration ($\mu g/m^3$)			Receptor Location[b]		Time Period	Florida
	Total	Modeled[a]	Background[c]	Direction (degree)	Distance (m)	(YYMMDDHH)	AAQS ($\mu g/m^3$)
HSH 8-Hour[d]	3,928	478	3,450	326	1700	90082912	10,000
HSH 1-Hour	10,262	3,822	6,440	326	1700	90082912	40,000

[a] Based on predicted HSH 1-hour concentration with 5-year meteorological record, West Palm Beach, 1987-91.
[b] Relative to Engine Discharge Location.
[c] Based on the HSH measured concentrations from 1/98-6/99 at West Palm Beach.
[d] Because no test emissions occur for the additional 7 hours of the period, set equal to 1/8 of 1-hour concentrations.
YYMMDDHH = Year, Month, Day, Hour Ending.
HSH = Highest, Second-Highest Concentration in 5 years.

7.0 ADDITIONAL IMPACT ANALYSIS

7.1 INTRODUCTION

The additional impact analysis addresses the potential impacts of the new rocket tests cell on vegetation, soils, and wildlife of the surrounding area and the nearest Class I area. The nearest Class I area is the Everglades NP, located approximately 120 km south of the proposed project. Because the facility is subject to the PSD NSR requirements for CO emissions, the additional impact analysis were performed for this pollutant.

According to the modeling results presented in Section 6.0, the maximum air quality impacts predicted for the project are slightly greater than the EPA's significant impact levels of 500 and 2,000 $\mu g/m^3$ for 8 hour and 1-hour maximum, respectively, and below the AAQS. As a result, regardless of the existing conditions in the vicinity of the site or in the Class I areas, the proposed project will not result in any significant adverse effects upon these areas.

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APPENDIX A

DETAILED SUMMARY OF ISCST MODEL RESULTS

ISCBOB3 RELEASE 98056

ISCST3 OUTPUT FILE NUMBER 1 :ENGTEST.087
ISCST3 OUTPUT FILE NUMBER 2 :ENGTEST.088
ISCST3 OUTPUT FILE NUMBER 3 :ENGTEST.089
ISCST3 OUTPUT FILE NUMBER 4 :ENGTEST.090
ISCST3 OUTPUT FILE NUMBER 5 :ENGTEST.091
First title for last output file is: 1987 PRATT & WHITTNEY LO2/RP1 ENGINE, CO IMPACTS 4/18/00
Second title for last output file is: 38 DEGREE DISCHARGE, 230 SECOND BURN

AVERAGING TIME	YEAR	CONC (ug/m3)	DIR (deg) or X (m)	DIST (m) or Y (m)	PERIOD ENDING (YYMMDDHH)
SOURCE GROUP ID: ALL					
HIGH 1-Hour					
	1987	2773.7	50.	5454.	87090711
	1988	4263.6	204.	1500.	88032713
	1989	3840.1	200.	1500.	89070114
	1990	4982.3	140.	1500.	90072212
	1991	2604.3	340.	3000.	91032913
HSH 1-Hour					
	1987	2659.9	50.	5454.	87071211
	1988	2394.7	284.	3000.	88091712
	1989	2266.8	40.	5322.	89070311
	1990	3543.2	326.	2000.	90082912
	1991	2085.2	150.	25000.	91083007

All receptor computations reported with respect to a user-specified origin

GRID	0.00	0.00
DISCRETE	0.00	0.00

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CO STARTING
CO TITLEONE 1987 PRATT & WHITTNEY LO2/RP1 ENGINE, CO IMPACTS          4/18/00
CO TITLETWO 38 DEGREE DISCHARGE, 230 SECOND BURN
CO MODELOPT DFAULT CONC   RURAL NOCMPL
CO AVERTIME 1
CO POLLUTID CO
CO DCAYCOEF     .000000
CO RUNORNOT RUN
CO FINISHED

SO STARTING

** Source Location Cards:
**          SRCID SRCTYP        XS              YS              ZS
** MODELING ORIGIN IS ROCKET ENGINE DISCHARGE LOCATION
** Source Location Cards:
**          SRCID      SRCTYP     XS         YS        ZS
**   UTM                          (m)        (m)       (m)
SO LOCATION  ENGINE    POINT      0.0        0.0       0.0
** Source Parameter Cards:
** POINT:   SRCID               QS      HS        TS        VS         DS
**                             (g/s)   (m)       (K)       (m/s)      (m)
SO SRCPARAM  ENGINE            21000.  21.3      383.2     12.20      18.3

SO EMISUNIT    .100000E+07 (GRAMS/SEC)          (MICROGRAMS/CUBIC-METER)
SO SRCGROUP ALL
SO FINISHED

RE STARTING
RE GRIDPOLR POL STA
RE GRIDPOLR POL ORIG  0.0   0.0
RE GRIDPOLR POL DIST  10000  12000  15000  20000  25000 30000
RE GRIDPOLR POL GDIR  36  10.00  10.00
RE GRIDPOLR POL END
RE DISCPOLR ENGINE     1215.          2
RE DISCPOLR ENGINE     1500.          2
RE DISCPOLR ENGINE     2000.          2
RE DISCPOLR ENGINE     2500.          2
RE DISCPOLR ENGINE     3000.          2
RE DISCPOLR ENGINE     1266.          4
RE DISCPOLR ENGINE     1500.          4
RE DISCPOLR ENGINE     2000.          4
RE DISCPOLR ENGINE     2500.          4
RE DISCPOLR ENGINE     3000.          4
RE DISCPOLR ENGINE     1322.          6
RE DISCPOLR ENGINE     1500.          6
RE DISCPOLR ENGINE     2000.          6
RE DISCPOLR ENGINE     2500.          6
RE DISCPOLR ENGINE     3000.          6
RE DISCPOLR ENGINE     1385.          8
RE DISCPOLR ENGINE     1500.          8
RE DISCPOLR ENGINE     2000.          8
RE DISCPOLR ENGINE     2500.          8
RE DISCPOLR ENGINE     3000.          8
RE DISCPOLR ENGINE     1457.         10
RE DISCPOLR ENGINE     1500.         10
RE DISCPOLR ENGINE     2000.         10
RE DISCPOLR ENGINE     2500.         10
RE DISCPOLR ENGINE     3000.         10
RE DISCPOLR ENGINE     1538.         12
RE DISCPOLR ENGINE     2000.         12
RE DISCPOLR ENGINE     2500.         12
RE DISCPOLR ENGINE     3000.         12
RE DISCPOLR ENGINE     1631.         14
RE DISCPOLR ENGINE     2000.         14
RE DISCPOLR ENGINE     2500.         14
RE DISCPOLR ENGINE     3000.         14
RE DISCPOLR ENGINE     1739.         16
RE DISCPOLR ENGINE     2000.         16
RE DISCPOLR ENGINE     2500.         16
RE DISCPOLR ENGINE     3000.         16
RE DISCPOLR ENGINE     1864.         18
RE DISCPOLR ENGINE     2000.         18
RE DISCPOLR ENGINE     2500.         18
RE DISCPOLR ENGINE     3000.         18
RE DISCPOLR ENGINE     2011.         20
RE DISCPOLR ENGINE     2500.         20
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RE DISCPOLR ENGINE	3000.	20
RE DISCPOLR ENGINE	2186.	22
RE DISCPOLR ENGINE	2500.	22
RE DISCPOLR ENGINE	3000.	22
RE DISCPOLR ENGINE	2398.	24
RE DISCPOLR ENGINE	2500.	24
RE DISCPOLR ENGINE	3000.	24
RE DISCPOLR ENGINE	2658.	26
RE DISCPOLR ENGINE	3000.	26
RE DISCPOLR ENGINE	2986.	28
RE DISCPOLR ENGINE	3000.	28
RE DISCPOLR ENGINE	3412.	30
RE DISCPOLR ENGINE	3984.	32
RE DISCPOLR ENGINE	4794.	34
RE DISCPOLR ENGINE	5316.	36
RE DISCPOLR ENGINE	5316.	38
RE DISCPOLR ENGINE	5322.	40
RE DISCPOLR ENGINE	5335.	42
RE DISCPOLR ENGINE	5355.	44
RE DISCPOLR ENGINE	5381.	46
RE DISCPOLR ENGINE	5414.	48
RE DISCPOLR ENGINE	5454.	50
RE DISCPOLR ENGINE	5502.	52
RE DISCPOLR ENGINE	5557.	54
RE DISCPOLR ENGINE	5621.	56
RE DISCPOLR ENGINE	5692.	58
RE DISCPOLR ENGINE	5773.	60
RE DISCPOLR ENGINE	5864.	62
RE DISCPOLR ENGINE	5964.	64
RE DISCPOLR ENGINE	6076.	66
RE DISCPOLR ENGINE	6199.	68
RE DISCPOLR ENGINE	6336.	70
RE DISCPOLR ENGINE	6487.	72
RE DISCPOLR ENGINE	6653.	74
RE DISCPOLR ENGINE	6837.	76
RE DISCPOLR ENGINE	7040.	78
RE DISCPOLR ENGINE	7265.	80
RE DISCPOLR ENGINE	7514.	82
RE DISCPOLR ENGINE	7790.	84
RE DISCPOLR ENGINE	8098.	86
RE DISCPOLR ENGINE	8442.	88
RE DISCPOLR ENGINE	8827.	90
RE DISCPOLR ENGINE	9261.	92
RE DISCPOLR ENGINE	9359.	94
RE DISCPOLR ENGINE	6246.	96
RE DISCPOLR ENGINE	4691.	98
RE DISCPOLR ENGINE	3760.	100
RE DISCPOLR ENGINE	3140.	102
RE DISCPOLR ENGINE	2699.	104
RE DISCPOLR ENGINE	3000.	104
RE DISCPOLR ENGINE	2369.	106
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RE DISCPOLR ENGINE	3000.	106
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RE DISCPOLR ENGINE	3000.	108
RE DISCPOLR ENGINE	1909.	110
RE DISCPOLR ENGINE	2000.	110
RE DISCPOLR ENGINE	2500.	110
RE DISCPOLR ENGINE	3000.	110
RE DISCPOLR ENGINE	1743.	112
RE DISCPOLR ENGINE	2000.	112
RE DISCPOLR ENGINE	2500.	112
RE DISCPOLR ENGINE	3000.	112
RE DISCPOLR ENGINE	1605.	114
RE DISCPOLR ENGINE	2000.	114
RE DISCPOLR ENGINE	2500.	114
RE DISCPOLR ENGINE	3000.	114
RE DISCPOLR ENGINE	1489.	116
RE DISCPOLR ENGINE	1500.	116
RE DISCPOLR ENGINE	2000.	116
RE DISCPOLR ENGINE	2500.	116
RE DISCPOLR ENGINE	3000.	116
RE DISCPOLR ENGINE	1391.	118
RE DISCPOLR ENGINE	1500.	118
RE DISCPOLR ENGINE	2000.	118
RE DISCPOLR ENGINE	2500.	118

RE DISCPOLR ENGINE	3000.	118
RE DISCPOLR ENGINE	1306.	120
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RE DISCPOLR ENGINE	2000.	120
RE DISCPOLR ENGINE	2500.	120
RE DISCPOLR ENGINE	3000.	120
RE DISCPOLR ENGINE	1232.	122
RE DISCPOLR ENGINE	1500.	122
RE DISCPOLR ENGINE	2000.	122
RE DISCPOLR ENGINE	2500.	122
RE DISCPOLR ENGINE	3000.	122
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RE DISCPOLR ENGINE	1500.	124
RE DISCPOLR ENGINE	2000.	124
RE DISCPOLR ENGINE	2500.	124
RE DISCPOLR ENGINE	3000.	124
RE DISCPOLR ENGINE	1111.	126
RE DISCPOLR ENGINE	1500.	126
RE DISCPOLR ENGINE	2000.	126
RE DISCPOLR ENGINE	2500.	126
RE DISCPOLR ENGINE	3000.	126
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RE DISCPOLR ENGINE	2000.	128
RE DISCPOLR ENGINE	2500.	128
RE DISCPOLR ENGINE	3000.	128
RE DISCPOLR ENGINE	1016.	130
RE DISCPOLR ENGINE	1500.	130
RE DISCPOLR ENGINE	2000.	130
RE DISCPOLR ENGINE	2500.	130
RE DISCPOLR ENGINE	3000.	130
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RE DISCPOLR ENGINE	1500.	132
RE DISCPOLR ENGINE	2000.	132
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RE DISCPOLR ENGINE	2500.	134
RE DISCPOLR ENGINE	3000.	134
RE DISCPOLR ENGINE	908.	136
RE DISCPOLR ENGINE	1000.	136
RE DISCPOLR ENGINE	1500.	136
RE DISCPOLR ENGINE	2000.	136
RE DISCPOLR ENGINE	2500.	136
RE DISCPOLR ENGINE	3000.	136
RE DISCPOLR ENGINE	879.	138
RE DISCPOLR ENGINE	1000.	138
RE DISCPOLR ENGINE	1500.	138
RE DISCPOLR ENGINE	2000.	138
RE DISCPOLR ENGINE	2500.	138
RE DISCPOLR ENGINE	3000.	138
RE DISCPOLR ENGINE	852.	140
RE DISCPOLR ENGINE	1000.	140
RE DISCPOLR ENGINE	1500.	140
RE DISCPOLR ENGINE	2000.	140
RE DISCPOLR ENGINE	2500.	140
RE DISCPOLR ENGINE	3000.	140
RE DISCPOLR ENGINE	829.	142
RE DISCPOLR ENGINE	1000.	142
RE DISCPOLR ENGINE	1500.	142
RE DISCPOLR ENGINE	2000.	142
RE DISCPOLR ENGINE	2500.	142
RE DISCPOLR ENGINE	3000.	142
RE DISCPOLR ENGINE	807.	144
RE DISCPOLR ENGINE	1000.	144
RE DISCPOLR ENGINE	1500.	144
RE DISCPOLR ENGINE	2000.	144
RE DISCPOLR ENGINE	2500.	144
RE DISCPOLR ENGINE	3000.	144
RE DISCPOLR ENGINE	788.	146
RE DISCPOLR ENGINE	1000.	146
RE DISCPOLR ENGINE	1500.	146
RE DISCPOLR ENGINE	2000.	146

RE DISCPOLR ENGINE	2500.	146
RE DISCPOLR ENGINE	3000.	146
RE DISCPOLR ENGINE	770.	148
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RE DISCPOLR ENGINE	3000.	156
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RE DISCPOLR ENGINE	2000.	160
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RE DISCPOLR ENGINE	2500.	162
RE DISCPOLR ENGINE	3000.	162
RE DISCPOLR ENGINE	679.	164
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RE DISCPOLR ENGINE	1500.	164
RE DISCPOLR ENGINE	2000.	164
RE DISCPOLR ENGINE	2500.	164
RE DISCPOLR ENGINE	3000.	164
RE DISCPOLR ENGINE	673.	166
RE DISCPOLR ENGINE	1000.	166
RE DISCPOLR ENGINE	1500.	166
RE DISCPOLR ENGINE	2000.	166
RE DISCPOLR ENGINE	2500.	166
RE DISCPOLR ENGINE	3000.	166
RE DISCPOLR ENGINE	667.	168
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RE DISCPOLR ENGINE	1500.	168
RE DISCPOLR ENGINE	2000.	168
RE DISCPOLR ENGINE	2500.	168
RE DISCPOLR ENGINE	3000.	168
RE DISCPOLR ENGINE	663.	170
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RE DISCPOLR ENGINE	2000.	170
RE DISCPOLR ENGINE	2500.	170
RE DISCPOLR ENGINE	3000.	170
RE DISCPOLR ENGINE	659.	172
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RE DISCPOLR ENGINE	1500.	172

RE DISCPOLR ENGINE	2000.	172
RE DISCPOLR ENGINE	2500.	172
RE DISCPOLR ENGINE	3000.	172
RE DISCPOLR ENGINE	656.	174
RE DISCPOLR ENGINE	1000.	174
RE DISCPOLR ENGINE	1500.	174
RE DISCPOLR ENGINE	2000.	174
RE DISCPOLR ENGINE	2500.	174
RE DISCPOLR ENGINE	3000.	174
RE DISCPOLR ENGINE	654.	176
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RE DISCPOLR ENGINE	1500.	176
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RE DISCPOLR ENGINE	2500.	176
RE DISCPOLR ENGINE	3000.	176
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RE DISCPOLR ENGINE	1500.	178
RE DISCPOLR ENGINE	2000.	178
RE DISCPOLR ENGINE	2500.	178
RE DISCPOLR ENGINE	3000.	178
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RE DISCPOLR ENGINE	2000.	186
RE DISCPOLR ENGINE	2500.	186
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RE DISCPOLR ENGINE	2000.	188
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RE DISCPOLR ENGINE	3000.	188
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RE DISCPOLR ENGINE	2000.	192
RE DISCPOLR ENGINE	2500.	192
RE DISCPOLR ENGINE	3000.	192
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RE DISCPOLR ENGINE	1500.	194
RE DISCPOLR ENGINE	2000.	194
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RE DISCPOLR ENGINE	3000.	194
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RE DISCPOLR ENGINE	1500.	196
RE DISCPOLR ENGINE	2000.	196
RE DISCPOLR ENGINE	2500.	196
RE DISCPOLR ENGINE	3000.	196
RE DISCPOLR ENGINE	686.	198
RE DISCPOLR ENGINE	1000.	198

RE DISCPOLR ENGINE	1500.	198
RE DISCPOLR ENGINE	2000.	198
RE DISCPOLR ENGINE	2500.	198
RE DISCPOLR ENGINE	3000.	198
RE DISCPOLR ENGINE	695.	200
RE DISCPOLR ENGINE	1000.	200
RE DISCPOLR ENGINE	1500.	200
RE DISCPOLR ENGINE	2000.	200
RE DISCPOLR ENGINE	2500.	200
RE DISCPOLR ENGINE	3000.	200
RE DISCPOLR ENGINE	704.	202
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RE DISCPOLR ENGINE	1500.	202
RE DISCPOLR ENGINE	2000.	202
RE DISCPOLR ENGINE	2500.	202
RE DISCPOLR ENGINE	3000.	202
RE DISCPOLR ENGINE	715.	204
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RE DISCPOLR ENGINE	1500.	204
RE DISCPOLR ENGINE	2000.	204
RE DISCPOLR ENGINE	2500.	204
RE DISCPOLR ENGINE	3000.	204
RE DISCPOLR ENGINE	726.	206
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RE DISCPOLR ENGINE	1500.	206
RE DISCPOLR ENGINE	2000.	206
RE DISCPOLR ENGINE	2500.	206
RE DISCPOLR ENGINE	3000.	206
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RE DISCPOLR ENGINE	2000.	208
RE DISCPOLR ENGINE	2500.	208
RE DISCPOLR ENGINE	3000.	208
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RE DISCPOLR ENGINE	2000.	210
RE DISCPOLR ENGINE	2500.	210
RE DISCPOLR ENGINE	3000.	210
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RE DISCPOLR ENGINE	3000.	212
RE DISCPOLR ENGINE	788.	214
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RE DISCPOLR ENGINE	1500.	214
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RE DISCPOLR ENGINE	3000.	214
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RE DISCPOLR ENGINE	2000.	216
RE DISCPOLR ENGINE	2500.	216
RE DISCPOLR ENGINE	3000.	216
RE DISCPOLR ENGINE	829.	218
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RE DISCPOLR ENGINE	1500.	218
RE DISCPOLR ENGINE	2000.	218
RE DISCPOLR ENGINE	2500.	218
RE DISCPOLR ENGINE	3000.	218
RE DISCPOLR ENGINE	852.	220
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RE DISCPOLR ENGINE	2000.	220
RE DISCPOLR ENGINE	2500.	220
RE DISCPOLR ENGINE	3000.	220
RE DISCPOLR ENGINE	879.	222
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RE DISCPOLR ENGINE	1500.	222
RE DISCPOLR ENGINE	2000.	222
RE DISCPOLR ENGINE	2500.	222
RE DISCPOLR ENGINE	3000.	222
RE DISCPOLR ENGINE	908.	224

RE DISCPOLR ENGINE	1000.	224
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RE DISCPOLR ENGINE	2000.	224
RE DISCPOLR ENGINE	2500.	224
RE DISCPOLR ENGINE	3000.	224
RE DISCPOLR ENGINE	940.	226
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RE DISCPOLR ENGINE	2500.	226
RE DISCPOLR ENGINE	3000.	226
RE DISCPOLR ENGINE	976.	228
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RE DISCPOLR ENGINE	2000.	228
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RE DISCPOLR ENGINE	3000.	228
RE DISCPOLR ENGINE	1016.	230
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RE DISCPOLR ENGINE	2000.	230
RE DISCPOLR ENGINE	2500.	230
RE DISCPOLR ENGINE	3000.	230
RE DISCPOLR ENGINE	1060.	232
RE DISCPOLR ENGINE	1500.	232
RE DISCPOLR ENGINE	2000.	232
RE DISCPOLR ENGINE	2500.	232
RE DISCPOLR ENGINE	3000.	232
RE DISCPOLR ENGINE	1111.	234
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RE DISCPOLR ENGINE	2000.	234
RE DISCPOLR ENGINE	2500.	234
RE DISCPOLR ENGINE	3000.	234
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RE DISCPOLR ENGINE	1500.	236
RE DISCPOLR ENGINE	2000.	236
RE DISCPOLR ENGINE	2500.	236
RE DISCPOLR ENGINE	3000.	236
RE DISCPOLR ENGINE	1232.	238
RE DISCPOLR ENGINE	1500.	238
RE DISCPOLR ENGINE	2000.	238
RE DISCPOLR ENGINE	2500.	238
RE DISCPOLR ENGINE	3000.	238
RE DISCPOLR ENGINE	1306.	240
RE DISCPOLR ENGINE	1500.	240
RE DISCPOLR ENGINE	2000.	240
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RE DISCPOLR ENGINE	3000.	240
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RE DISCPOLR ENGINE	1500.	244
RE DISCPOLR ENGINE	2000.	244
RE DISCPOLR ENGINE	2500.	244
RE DISCPOLR ENGINE	3000.	244
RE DISCPOLR ENGINE	1605.	246
RE DISCPOLR ENGINE	2000.	246
RE DISCPOLR ENGINE	2500.	246
RE DISCPOLR ENGINE	3000.	246
RE DISCPOLR ENGINE	1743.	248
RE DISCPOLR ENGINE	2000.	248
RE DISCPOLR ENGINE	2500.	248
RE DISCPOLR ENGINE	3000.	248
RE DISCPOLR ENGINE	1909.	250
RE DISCPOLR ENGINE	2000.	250
RE DISCPOLR ENGINE	2500.	250
RE DISCPOLR ENGINE	3000.	250
RE DISCPOLR ENGINE	1952.	252
RE DISCPOLR ENGINE	2000.	252
RE DISCPOLR ENGINE	2500.	252
RE DISCPOLR ENGINE	3000.	252
RE DISCPOLR ENGINE	1931.	254
RE DISCPOLR ENGINE	2000.	254
RE DISCPOLR ENGINE	2500.	254
RE DISCPOLR ENGINE	3000.	254

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RE DISCPOLR ENGINE	2000.	256
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RE DISCPOLR ENGINE	3000.	256
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RE DISCPOLR ENGINE	2000.	258
RE DISCPOLR ENGINE	2500.	258
RE DISCPOLR ENGINE	3000.	258
RE DISCPOLR ENGINE	1885.	260
RE DISCPOLR ENGINE	2000.	260
RE DISCPOLR ENGINE	2500.	260
RE DISCPOLR ENGINE	3000.	260
RE DISCPOLR ENGINE	1874.	262
RE DISCPOLR ENGINE	2000.	262
RE DISCPOLR ENGINE	2500.	262
RE DISCPOLR ENGINE	3000.	262
RE DISCPOLR ENGINE	1866.	264
RE DISCPOLR ENGINE	2000.	264
RE DISCPOLR ENGINE	2500.	264
RE DISCPOLR ENGINE	3000.	264
RE DISCPOLR ENGINE	1861.	266
RE DISCPOLR ENGINE	2000.	266
RE DISCPOLR ENGINE	2500.	266
RE DISCPOLR ENGINE	3000.	266
RE DISCPOLR ENGINE	1857.	268
RE DISCPOLR ENGINE	2000.	268
RE DISCPOLR ENGINE	2500.	268
RE DISCPOLR ENGINE	3000.	268
RE DISCPOLR ENGINE	1856.	270
RE DISCPOLR ENGINE	2000.	270
RE DISCPOLR ENGINE	2500.	270
RE DISCPOLR ENGINE	3000.	270
RE DISCPOLR ENGINE	1857.	272
RE DISCPOLR ENGINE	2000.	272
RE DISCPOLR ENGINE	2500.	272
RE DISCPOLR ENGINE	3000.	272
RE DISCPOLR ENGINE	1861.	274
RE DISCPOLR ENGINE	2000.	274
RE DISCPOLR ENGINE	2500.	274
RE DISCPOLR ENGINE	3000.	274
RE DISCPOLR ENGINE	1866.	276
RE DISCPOLR ENGINE	2000.	276
RE DISCPOLR ENGINE	2500.	276
RE DISCPOLR ENGINE	3000.	276
RE DISCPOLR ENGINE	1874.	278
RE DISCPOLR ENGINE	2000.	278
RE DISCPOLR ENGINE	2500.	278
RE DISCPOLR ENGINE	3000.	278
RE DISCPOLR ENGINE	1885.	280
RE DISCPOLR ENGINE	2000.	280
RE DISCPOLR ENGINE	2500.	280
RE DISCPOLR ENGINE	3000.	280
RE DISCPOLR ENGINE	1898.	282
RE DISCPOLR ENGINE	2000.	282
RE DISCPOLR ENGINE	2500.	282
RE DISCPOLR ENGINE	3000.	282
RE DISCPOLR ENGINE	1913.	284
RE DISCPOLR ENGINE	2000.	284
RE DISCPOLR ENGINE	2500.	284
RE DISCPOLR ENGINE	3000.	284
RE DISCPOLR ENGINE	1931.	286
RE DISCPOLR ENGINE	2000.	286
RE DISCPOLR ENGINE	2500.	286
RE DISCPOLR ENGINE	3000.	286
RE DISCPOLR ENGINE	1952.	288
RE DISCPOLR ENGINE	2000.	288
RE DISCPOLR ENGINE	2500.	288
RE DISCPOLR ENGINE	3000.	288
RE DISCPOLR ENGINE	1975.	290
RE DISCPOLR ENGINE	2000.	290
RE DISCPOLR ENGINE	2500.	290
RE DISCPOLR ENGINE	3000.	290
RE DISCPOLR ENGINE	2002.	292
RE DISCPOLR ENGINE	2500.	292
RE DISCPOLR ENGINE	3000.	292
RE DISCPOLR ENGINE	2032.	294
RE DISCPOLR ENGINE	2500.	294

RE DISCPOLR ENGINE	3000.	294
RE DISCPOLR ENGINE	2065.	296
RE DISCPOLR ENGINE	2500.	296
RE DISCPOLR ENGINE	3000.	296
RE DISCPOLR ENGINE	2065.	298
RE DISCPOLR ENGINE	2500.	298
RE DISCPOLR ENGINE	3000.	298
RE DISCPOLR ENGINE	1939.	300
RE DISCPOLR ENGINE	2000.	300
RE DISCPOLR ENGINE	2500.	300
RE DISCPOLR ENGINE	3000.	300
RE DISCPOLR ENGINE	1829.	302
RE DISCPOLR ENGINE	2000.	302
RE DISCPOLR ENGINE	2500.	302
RE DISCPOLR ENGINE	3000.	302
RE DISCPOLR ENGINE	1733.	304
RE DISCPOLR ENGINE	2000.	304
RE DISCPOLR ENGINE	2500.	304
RE DISCPOLR ENGINE	3000.	304
RE DISCPOLR ENGINE	1649.	306
RE DISCPOLR ENGINE	2000.	306
RE DISCPOLR ENGINE	2500.	306
RE DISCPOLR ENGINE	3000.	306
RE DISCPOLR ENGINE	1574.	308
RE DISCPOLR ENGINE	2000.	308
RE DISCPOLR ENGINE	2500.	308
RE DISCPOLR ENGINE	3000.	308
RE DISCPOLR ENGINE	1508.	310
RE DISCPOLR ENGINE	2000.	310
RE DISCPOLR ENGINE	2500.	310
RE DISCPOLR ENGINE	3000.	310
RE DISCPOLR ENGINE	1449.	312
RE DISCPOLR ENGINE	1500.	312
RE DISCPOLR ENGINE	2000.	312
RE DISCPOLR ENGINE	2500.	312
RE DISCPOLR ENGINE	3000.	312
RE DISCPOLR ENGINE	1395.	314
RE DISCPOLR ENGINE	1500.	314
RE DISCPOLR ENGINE	2000.	314
RE DISCPOLR ENGINE	2500.	314
RE DISCPOLR ENGINE	3000.	314
RE DISCPOLR ENGINE	1347.	316
RE DISCPOLR ENGINE	1500.	316
RE DISCPOLR ENGINE	2000.	316
RE DISCPOLR ENGINE	2500.	316
RE DISCPOLR ENGINE	3000.	316
RE DISCPOLR ENGINE	1304.	318
RE DISCPOLR ENGINE	1500.	318
RE DISCPOLR ENGINE	2000.	318
RE DISCPOLR ENGINE	2500.	318
RE DISCPOLR ENGINE	3000.	318
RE DISCPOLR ENGINE	1265.	320
RE DISCPOLR ENGINE	1500.	320
RE DISCPOLR ENGINE	2000.	320
RE DISCPOLR ENGINE	2500.	320
RE DISCPOLR ENGINE	3000.	320
RE DISCPOLR ENGINE	1230.	322
RE DISCPOLR ENGINE	1500.	322
RE DISCPOLR ENGINE	2000.	322
RE DISCPOLR ENGINE	2500.	322
RE DISCPOLR ENGINE	3000.	322
RE DISCPOLR ENGINE	1198.	324
RE DISCPOLR ENGINE	1500.	324
RE DISCPOLR ENGINE	2000.	324
RE DISCPOLR ENGINE	2500.	324
RE DISCPOLR ENGINE	3000.	324
RE DISCPOLR ENGINE	1169.	326
RE DISCPOLR ENGINE	1500.	326
RE DISCPOLR ENGINE	2000.	326
RE DISCPOLR ENGINE	2500.	326
RE DISCPOLR ENGINE	3000.	326
RE DISCPOLR ENGINE	1143.	328
RE DISCPOLR ENGINE	1500.	328
RE DISCPOLR ENGINE	2000.	328
RE DISCPOLR ENGINE	2500.	328
RE DISCPOLR ENGINE	3000.	328
RE DISCPOLR ENGINE	1119.	330

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