

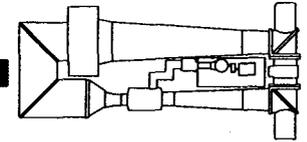
**An Alternate to Closing
the
Jet Exit Test Facility**

**presented to
H. Lee Beach
March 28, 1997**



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Aero- and Gas- Dynamics Division*

AGDD Facilities on Closure List

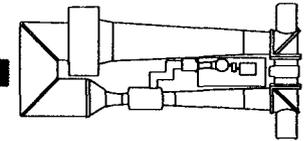


Facility	Closure Date
8' TPT	1996
6"x19" TT	1997
26" & 6"x28" TT's	1997
M17 N2 Tunnel	1997
JETF	1998
LTPT	2000



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FY 97 Operating Cost of AGDD Facilities on Closure List



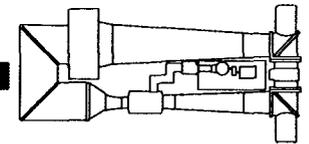
Facility	Closure Year	M&O + Utilities, \$K	RTG CS	IOG CS	CS Cost, \$K	Total Cost, \$K
8' TPT	1996	1388	4	14	1040	2428
6"x19" TT	1997	8	0	0	0	8
26" & 6"x28" TT's	1997	173	0	0	0	173
M17 N2 Tunnel	1997	371	0	0	0	371
JETF	1998	112	2	2	260	372
LTPT	2000	548	6	6	988	1328

NOTE: Based on Chain Saw Core Facilities cost information. Staffing at JETF changed to reflect actuals. FY 97 \$'s. Cost of facilities closed prior to 1997 projected to 1997.



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FY 97 Savings Due to Closure of AGDD Facilities



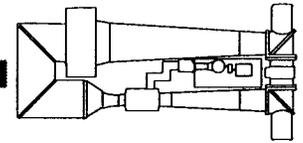
Facility	Closure Year	M&O + Utilities, \$K	CS Cost, \$K	Total Cost, \$K	Savings W/O Labor, \$K	Savings W/Labor, \$K
8' TPT	1996	1388	1040	2428	537.6	574.8
6"x19" TT	1997	8	0	8	7	7
26" & 6"x28" TT's	1997	173	0	173	83	112
M17 N2 Tunnel	1997	371	0	371	150	312
JETF	1998	112	260	372	81	111
LTPT	2000	548	780	1328		316

NOTE: FY 97 \$'s. Cost of facilities closed prior to 1997 projected to 1997.



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Potential Savings Due to Closure of Some Other Facilities

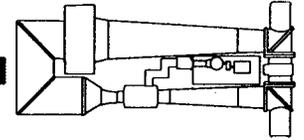


Facility	Closure Year	M&O + Utilities, \$K	CS Cost, \$K	Total Cost, \$K	Savings W/O Labor, \$K	Savings W/Labor, \$K
NTC	1997	209	300	509	124	202



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Recomendation

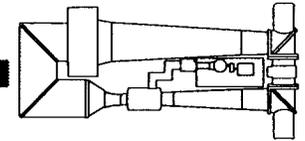


- Keep JETF open and mothball NTC
 - Mothballing NTC results in a savings of \$202K per year.
 - Closing JETF saves only \$111K per year.



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JET EXIT TEST FACILITY



- **JETF (B1234) is an operational ground test stand with dual-flow propulsion simulation capability used for nozzle and propulsion system component performance and calibration testing**

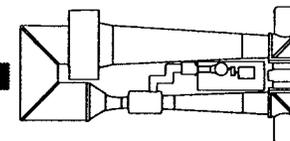
- **Facility is continually used but accessible to research customers**
 - Schedule generally flexible, avg. occupancy factor since 1985 is 90%; Facility overhead is small (2 person operation, low elect. requirements); Models are inexpensive
 - > Allows timely research, configuration assessment, and problem solution
 - > Encourages risk taking and innovative ideas
 - > Provides access to a research facility

- **Highly productive facility**
 - Since 1985
 - > Over 72 papers published on research conducted in JETF
 - > Approx. 80 research programs (1/3 in-house and 2/3 coop. w/industry & DOD)



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JET EXIT TEST FACILITY

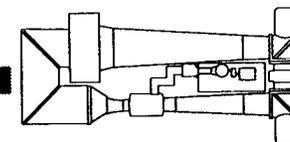


- **JETF has added value to the aero. community**
 - External customers (62% of occupancy)
 - > Allison, Boeing, DOD, GE, General Dynamics, McAIR, Northrop, P&W, Rohr
 - > Contributions to B-2, F-15/SMTD, F-22, X-31, F-15/Active, F-18/HARV, HSR, JAST/JSF
 - > Nozzle data base developed in JETF allowed GE to define the JAFE exhaust system without conducting independent scale-model tests and reduce their development costs and design cycle time.
 - Produced advanced products and technologies for future aircraft
 - > “Home” of the 2-D or nonaxisymmetric nozzle
 - Initial 2-D C-D, Wedge, SERN concepts
 - McAIR/P&W F-15/SMTD 2-D C-D pitch vectoring/reversing nozzle
 - P&W Spherical Convergent Flap Nozzle (SCFN) for F-22 and F-15/Active
 - > “Home” of multiaxis thrust vectoring
 - Initial multiaxis thrust vectoring concepts including F-18/HARV external vane concept
 - Provided multiaxis thrust vectoring envelopes for X-31 and F-18/HARV configurations
 - > Other
 - Innovative thrust reverser concepts for subsonic transports
 - Grumman blockerless reverser
 - LO, lightweight, affordable (fixed geometry) nozzle concepts (PIANO, LOLA, SALIENT)
 - Fluidic control of nozzle areas and thrust vectoring (FLINT)
 - STOVL nozzle concepts (HIDEN)



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JET EXIT TEST FACILITY



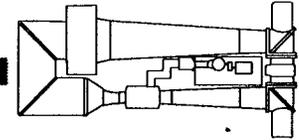
- **JETF is still required by industry**
 - Future external customers (86% of known occupancy)
 - > Boeing, DOD, Dept. of Justice, GE, Lockheed-Martin, P&W, Rohr
 - > Current schedule full through 1/16/98 (P&W request submitted for FY00)
 - > Lockheed has requested 5 entries during FY97 in support of JSF
 - > Boeing P&W has sent letter to Roy Harris requesting reconsideration of shut-down decision

- **JETF is still needed for high risk research**
 - Current high risk technologies scheduled for JETF
 - > Fluidic control of nozzle areas
 - > Fluidic thrust vectoring
 - > Fixed geometry nozzles
 - > Blockerless thrust reversers
 - > Counterflow thrust vectoring
 - > Active flow control
 - > Smart materials - Shape Memory Alloy (SMA) control of nozzle area



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JET EXIT TEST FACILITY VS NTC



JETF

- Operational
- Broad flow angle capability
 - > Cruise to reverse flow
- Limited NPR range
 - > Less than 20

NTC

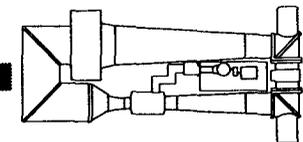
- Unproved capabilities
- Limited flow angles
 - > Cruise to low TV angles only
- Broad NPR range
 - > Up to 350

• SAVINGS RESULTING FROM JETF SHUT-DOWN

1. Direct test crew cost (JETF - 2) (NTC -3)
 - > Net savings = (-\$32K)
2. Maintenance costs (similar valves/piping/etc) move from JETF to NTC
 - > Net savings = \$0
3. Test consumables (H.P. Air, etc.) higher for NTC (pumps for back pressure control)
 - > Net savings = (-\$20K)
4. Electrical, air conditioning, heat, etc small but higher for JETF because of larger space
 - > Net savings = (NTC volume/JETF volume) X current JETF cost << \$52K
5. Cost of move (data system, flow control system, facility specific hardware)
 - > \$500K



JET EXIT TEST FACILITY VS NTC



JETF

- Operational
- Broad flow angle capability
 - > Cruise to reverse flow
- Limited NPR range
 - > Less than 20

NTC

- Unproved capabilities
- Limited flow angles
 - > Cruise to low TV angles only
- Broad NPR range
 - > Up to 350

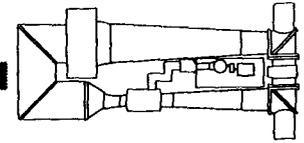
Facility	M&O + Utilities, \$K	RTG/ IOG CS	CS Cost, \$K	Total Cost, \$K	Savings W/O Labor \$K	Savings W/Labor, \$K
JETF	112	2/2	260	372	81	111
NTC	209	2/3	300	509	124	202



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Additional cost to move data system, instrumentation, flow control system and facility specific hardware may be as high as \$500K

Facilities in Building 1247D

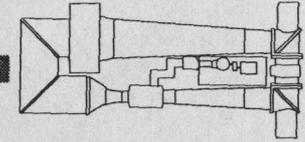


- 12" Mach 6 High Reynolds Number (Closed 1997)
- 20" Mach 6 Hypersonic Tunnel
- 20" Supersonic Wind Tunnel
- Supersonic Low Disturbance Tunnel
- Mach 8 Low Disturbance Tunnel
- Nozzle Test Chamber (NTC)
- Fluids Mechanics Lab (8 small facilities)



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Cost Saving for Closing Any Major Facility in Building 1247D



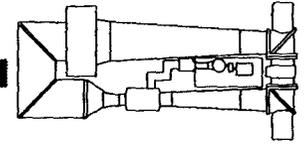
- Building 1247D Maintenance & Utility Cost = \$1.045M
- Fluid Mech. Lab M&U estimated at \$8K.
- M&U for each major facility is 1/6 of (\$1045K-\$8K) = \$173K
 - Maintenance Savings is $(\$173K + \$2K) \times 0.75 = \$130K$
 - Utility Savings is $\$553K / 6 = \$79K$



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Note: Analysis from Proposed Facility Closure Summary for ZBR
Implementation Plan date 3/4/96

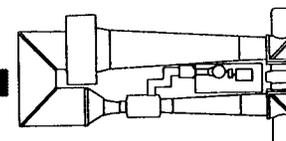
Summary Remarks



- JETF is an important facility for basic research with high customers demand.
- NTC alone does not provide test capabilities needed.
- The high pressure ratio capability of NTC was developed primarily to support future high Mach number vehicles.
- Cost saving for mothballing NTC greater than savings for closing JETF.
- Additional R&D funding (source unknown) required to make NTC and operational facility.
- Operating NTC at demand levels similar to JETF could result in significant resource conflicts with other B1247 facilities.



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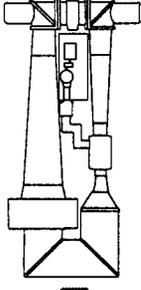
Background Information



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JETF/NTC Tests Requested

after 9/30/97



- JETF
 - P&W Counterflow Nozzle
 - LMAS HPA Exhaust Component
 - Smart Control Nozzle (DDF)
 - LM JSF Nozzle Calibrations for tests in 14x22 ST (multiple)
 - GE Thrust Reverser
 - P&W Smart Nozzle
- NTC
 - None



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