

PREPRODUCTION INITIATIVE STATIONARY AIR START SYSTEM TEST PLAN

SITE: NAVAL AIR STATION, NORTH ISLAND

1.0 OBJECTIVE

This test plan describes the data collection procedure for evaluating the use of a stationary air start system (SASS) to replace turbine-powered jet air start units (JASUs) in a Navy operational environment. The data will be used to determine the system's efficiency, effectiveness, and overall success with respect to starting T-700 engines under test by the AIMD. The environmental and cost benefits of starting the engines with the SASS system versus using a JASU include:

- Eliminate air emissions caused by the JASUs currently used by AIMD.
- Greatly reduce noise emissions caused by the JASUs. (JASUs typically operate at approximately 120 dB(A); the proposed system will operate at approximately 80 dB(A).)
- Eliminate the possibility of fuel and oil leakage from the JASUs.
- Reduce maintenance costs associated with JASU operation, including hazardous material usage and hazardous waste generation.
- Improve the reliability of equipment at the AIMD and reduce downtime due to failure of JASUs.

2.0 DESCRIPTION

T-700 aircraft engines are tested at the AIMD Test Cells after maintenance has been performed. Currently, when an engine start is required at AIMD turbine engine Test Cells, the operators must utilize a JASU obtained from the ground support equipment shop. The JASU design currently being used has been in the Navy since the late 1950s, and they are increasingly expensive to maintain and overhaul. Because of the age of this equipment, oil and fuel leaks and frequent failures are typical. As a replacement for JASUs, the SASS will provide an electrically driven, rotary screw, air compressor start system that will reduce noise, emissions, fuel leak/consumption, oil leak/consumption; will be much safer to operate; and will be more reliable.

The SASS consists of an air compressor, air storage tanks, and piping for the delivery of pressurized air to the test cells. The compressor is an electric-powered, rotary screw-driven compressor that supplies 100 psig at 1100 cubic feet per minute (cfm) and includes an air drying system. The compressor is powered by an electric motor (460V, 200 hp) that requires 500-amp service.

The compressed air is stored in two sets of above-ground storage tank systems until an air start is required. Approximately four to ten engine starts are required per week. The air is then sent through underground piping and delivered to the test cell. The Program Element Master Plan (PEMP) data list the airflow requirement for the T-700 engine as 96 lb-m/min. at 52 psia for 30 seconds on a normal start. Additional airflow of up to 1 minute may be required to windmill the motor after an emergency shutdown. The windmilling procedure purges the engine.

3.0 TEST PLAN

This test plan will be used to evaluate the effectiveness of the stationary air start system. Quantitative and qualitative data will be collected and used to evaluate the system's ability to replace the JASU and to identify expected environmental benefits, cost savings, and mission-readiness improvements.

3.1 Approach

The stationary air start system will be constructed to service three T-700 test cells during the implementation of this test plan, with the capacity to expand to four test cells as required at a later date. Quantitative and qualitative data will be collected by the completion of data collection sheets.

3.2 Instructions for Completing the Jet Air Start Unit (JASU) Baseline Data Collection Sheet – Table 1

The JASU Baseline Data Collection Sheet (Table 1) will be used by NASNI AIMD personnel to record usage data for the JASU. During the test period, the data sheet will be completed every day that the JASU is used. Each data sheet corresponds to one day of operation—up to a maximum of four engine starts per day. If more than four engine starts are done in one day, additional data sheets should be completed.

- **Date** – Indicate the date on which the JASU was used to start an engine.
- **Operator(s)** – Indicate the name of the operator(s) operating the JASU to start the engine.
- **Start/Finish Time** – Indicate the time the JASU was turned on and off for each engine start.
- **How long was actual airflow time (quality of start)?** - Indicate how long, in minutes, the air was flowing from the JASU, regardless of how long the engine was running.
- **How long for “windmilling”** – During the time that the JASU was operating, indicate how long, in minutes, the engine was windmilled and why.
- **Was the JASU immediately available?** – If the JASU was not immediately available for the engine start, indicate why and how long before it became available. Or, if the JASU had to be moved prior to use, indicate how long it took to move the equipment. If it was immediately available, put an “NA” in these columns.

- **Did you have to move the JASU before use?** – If the JASU had to be moved before the engine start, indicate how far it was moved (in feet) and if a tow tractor was available for the move. If the JASU was not required to be moved before operation, put an “NA” in these columns.
- **Was refueling required?** – Indicate whether the JASU required refueling by choosing “Yes” or “No.” If refueling was required, indicate the quantity in gallons.
- **List Materials or Consumables and Quantities Used** – List the type and quantity of consumables required to operate the JASU. Indicate a “Yes” in the HM column if the consumable was a hazardous material. List all hazardous materials in pounds. Examples may include adding oil to the JASU or adding electrolytes to the battery.
- **Did the JASU fail to operate or to provide air?** – Indicate if the JASU failed to operate or to provide air and describe the malfunction.
- **Did using the JASU generate any waste or leaks?** – If wastes were generated or leaks occurred during JASU use, describe what happened and specify the quantities.
- **Comments** - List any comments, general and specific, that pertain to the condition, operation, and safety concerns of the JASU, as well as and any other applicable/relevant comments.

3.3 Instructions for Completing the Stationary Air Start System (SASS) Data Collection Sheet (Table 2)

The Stationary Air Start System Data Collection Sheet (Table 2) will be used by AIMD personnel to record usage data for the SASS. During the test period, the data sheet will be completed every day that the SASS is used. Each data sheet corresponds to one day of operation—up to a maximum of four engine starts per day. If more than four engine starts are completed in one day, complete additional data sheets.

- **Date** – Indicate the date on which the SASS was used to start an engine.
- **Operator(s)** – Indicate the name of the operator(s) operating the SASS.
- **Start/Finish Time** – Indicate when the air regulator was turned on and off, for each engine start.
- **How long for “windmilling”?** – During the time that the air regulator was operating, indicate how long, in minutes, the engine was windmilled and why.
- **Did the aircraft engine start?** – Indicate whether the aircraft engine started by marking “yes” or “no” in this column.
- **Was the air compressor immediately available?** – If the SASS was not immediately available for the engine start, indicate why and how long before it became available. If it was immediately available, put an “NA” in these columns.
- **Air Pressure** – Record the air pressure in psi’s (from the gauge).
- **List Materials or Consumables and Quantities Used** – List the type and quantity of consumables required to operate the SASS. Indicate a “Yes” in the HM column if the consumable was a hazardous material. List all hazardous materials in pounds. Examples may include adding oil to the compressor.
- **What O-level maintenance was required during use?** – If any maintenance was required on the air compressor (generating the air), the components of the air regulator box (to which the air hose is connected), or associated piping (without

contacting the Public Works Center [PWC]), describe the maintenance required. **NOTE: If the components of the air regulator box require repairs, these should be arranged through Geneen McQuaid of UTRS or John Hammond of NAVAIR Lakehurst.**

- **Did using the SASS or related piping generate any waste or leaks?** – If wastes were generated or leaks occurred during SASS use, describe what happened and what quantities were used.
- **Comments** - List any comments, general and specific, that pertain to the condition, operation, and safety concerns of the SASS, as well as any other applicable/relevant comments.

3.4 Instructions for Completing the Maintenance and Repair Data Sheet (Table 3)

The Maintenance and Repair Data Collection Sheet (Table 3) should be completed each time maintenance or repair work is done on the air compressor or JASU, and submitted at least once per month during the evaluation period. The Maintenance and Repair Data Sheet shall be supplied by AIMD to the GSE shop when the JASU is sent for maintenance. **Note: If the components of the air regulator box on the test cell require repairs, the repairs should be arranged through Geneen McQuaid of UTRS or John Hammond of NAVAIR Lakehurst.**

- **Maintenance Shop ID** – Indicate the maintenance department that is conducting the maintenance or repair (GSE for the JASU and PWC for the air compressor).
- **Maintenance POC(s)** – Indicate the name of the Maintenance POC conducting the repair or maintenance.
- **Date** – Indicate the date on which maintenance began.
- **Equipment Needing Maintenance or Repair** – Indicate whether the maintenance/repair is being conducted on the air compressor or the JASU.
- **Describe Maintenance or Repair** – Describe the maintenance or repair conducted, including whether or not this is a scheduled maintenance.
- **JASU ID #** - Indicate the identification number of the JASU being maintained or repaired.
- **Man-hours to Perform Maintenance or Repair** – Indicate how many man-hours it took to perform the maintenance or repair.
- **Equipment Downtime** – Indicate how long the equipment was inoperable due to maintenance or repair; include units (i.e., hours, days, or weeks, etc.).
- **Hazardous Materials or Other Consumables Used During Maintenance and Repair** - Describe the type and quantity of consumables used during maintenance and repair work. List all hazardous materials in pounds. Indicate “Yes” in the HM column if the consumable was a hazardous material.
- **Waste Generated During Maintenance or Repair** – Describe the type and quantity of waste generated during maintenance and repair work. Indicate a “Yes” in the “Haz” column if the waste was hazardous.

3.5 Instructions for Completing the Noise Monitoring Data Sheet (Table 4)

An onsite industrial hygienist will measure engine noise by taking the following measurements.

Location	Measurements (JASU)	Measurements (SASS)
Operator's station	2	3
5-foot radius	2	3
10-foot radius	2	3

During this test period, the noise level generated by each air start system should be measured in decibel levels at different locations relative to the system. The measurement shall include the noise level of the air start system before the engine is started, which will ensure that only the sound of the air system and not the sound of the running engine shall be measured. Two measurement events shall be conducted while the JASU is being used, prior to the installation of the SASS, as baseline data. Repeat measurements shall be taken monthly after the SASS is installed, for three months. For each measurement, indicate the date on which the measurement was taken and the initials of the industrial hygienist taking the measurements. A different measurement shall be taken and recorded on Table 4 for each air start system at different locations relative to the SE (e.g., at operator's station, at a 5-foot radius, and at a 10-foot radius).

4.0 REPORTING

As previously described, the Data Collection Sheets will be completed each time either the JASU or the SASS is used, and the Maintenance and Repair Log Sheet will be completed each time maintenance or a repair is required on the air compressor or the JASU. Data will be collected for one year. During the evaluation period, the data sheets will be faxed or e-mailed to Geneen McQuaid of UTRS and John Hammond of NAVAIR Lakehurst (see Section 4.1, Points of Contact, for the fax number and e-mail address) monthly, at a minimum. The final report, as prepared by UTRS, will include information on the system's safety, overall performance, cost-effectiveness, and ability to interface with site operations.

4.1 Points of Contact

If at any time during the prototype period, the SASS equipment malfunctions, or consumables or technical support is needed, please contact the assigned POC at UTRS and/or NAVAIR Lakehurst as listed below. Do not contact the vendor directly unless there is an emergency. Do not make any repairs to the equipment yourself as this may invalidate warranties. Please discuss any ideas you may have regarding equipment modifications or improvements with NAVAIR Lakehurst or UTRS. Do not discuss ideas with the vendor as contractual problems may arise. NAVAIR Lakehurst and UTRS will arrange and procure all reasonable orders for consumables and repairs as soon as possible to ensure minimal impact to your site's operations. Please keep in mind that regular communication with NAVAIR Lakehurst and UTRS, and regular submittal of your data sheets are both vital to the success of this technology demonstration.

POC	Geneen McQuaid	John Hammond
Affiliation	UTRS, Cherry Hill, NJ	Code 4.8.2.2, Lakehurst, NJ
Phone No.	(856) 667-6770	(732) 323-7148 DSN 624-7148
Fax No.	(856) 667-7586	(732) 323-4810
E-mail	gmcquaid@utrsmail.com	john.hammond@navy.mil

**TABLE 1
DATA COLLECTION SHEET
STATIONARY AIR START SYSTEM PPEP PROJECT**

Jet Air Start Unit (JASU) – BASELINE DATA ONLY. DO NOT USE WITH SASS

DATE: _____ **OPERATOR(S):** _____

Start/ Finish Time	How long was actual airflow time (minutes) (quality of start)?	How long for “windmilling” (minutes)? Why?	Was JASU immediately available?*		Did you have to move the JASU before use? **		Was refueling required?		List Materials or Consumables and Quantities Used			Did JASU fail to operate or provide air?	
			If no, why?	If no, how long was the wait?	If yes, how far away was the JASU? (feet)	If yes, was a tow tractor available? (Y or N)	Y/N	Qty (gal)	Type of Material	Qty	HM (Y/N)	Y/N	If yes, what was the malfunction?

* Mark “NA” if the JASU was immediately available.

** Mark “NA” if you did not have to move the JASU prior to use.

Did using the JASU generate any waste or leaks? If so, what kind and how much? _____

Comments? _____

Fax or e-mail this data sheet to Geneen McQuaid (856-667-7586 or gmcquaid@utrsmail.com) and John Hammond (732-323-4810 or john.hammond@navy.mil) once the sheet is full or once per month at a minimum.

**TABLE 2
DATA COLLECTION SHEET
STATIONARY AIR START SYSTEM PPEP PROJECT**

Stationary Air Start System (SASS) – *USE ONLY WITH SASS OPERATION*

DATE: _____

OPERATOR(S): _____

Start/ Finish Time	How long for “windmilling” (minutes)? Why?	Did the aircraft engine start (Yes or No)?	Was air compressor immediately available?*		Air Pressure (psig)	List Materials or Consumables and Quantities Used			What O-level maintenance was required during use?
			If no, why?	If no, how long was the wait?		Type of Material	Quantity (gal)	HM (Y/N)	

* Mark “NA” if the JASU was immediately available.

** Mark “NA” if you did not have to move the JASU prior to use.

Did using the SASS or related piping generate any waste or leaks? If so, what kind and how much?

Comments? _____

Fax or e-mail this data sheet to Geneen McQuaid (856-667-7586 or gmcquaid@utrsmail.com) and John Hammond (732-323-4810 or john.hammond@navy.mil) once sheet is full or at least once per month.

**TABLE 3
DATA COLLECTION SHEET
STATIONARY AIR START SYSTEM PPEP PROJECT
MAINTENANCE/REPAIR**

MAINTENANCE SHOP ID: _____ **MAINTENANCE POC(S):** _____

Date	Equipment Needing Maintenance or Repair (JASU or Compressor)	Describe Maintenance or Repair (Indicate if Scheduled Maintenance)	JASU ID No.	Man-hours to Perform Maintenance or Repair (Hours)	Equipment Downtime (Indicate Hours, Days, Weeks)	Hazardous Materials or Other Consumables Used During Maintenance or Repair			Waste Generated During Maintenance or Repair		
						Type of Material	Quantity (Lb)	HM (Y/N)	Type	Quantity (Lb)	Haz (Y/N)

Fax or e-mail this data sheet to Geneen McQuaid (856-667-7586 or gmcquaid@utrsmail.com) and John Hammond (732-323-4810 or john.hammond@navy.mil) once the sheet is full, or at least once per month.

**TABLE 4
NOISE MONITORING DATA SHEET**

Date: _____ **IH Initials:** _____

Location	Equipment	dB level
Operator's Station	JASU	
5-foot Radius	JASU	
10-foot Radius	JASU	

Date: _____ **IH Initials:** _____

Location	Equipment	dB level
Operator's Station	JASU	
5-foot Radius	JASU	
10-foot Radius	JASU	

Date: _____ **IH Initials:** _____

Location	Equipment	dB level
Operator's Station	SASS	
5-foot Radius	SASS	
10-foot Radius	SASS	

Date: _____ **IH Initials:** _____

Location	Equipment	dB level
Operator's Station	SASS	
5-foot Radius	SASS	
10-foot Radius	SASS	

Date: _____ **IH Initials:** _____

Location	Equipment	dB level
Operator's Station	SASS	
5-foot Radius	SASS	
10-foot Radius	SASS	

JASU = Jet Air Start System (baseline measurement)
SASS = Stationary Air Start System

Fax or e-mail to: John Hammond (732-323-4810 or john.hammond@navy.mil) and Geneen McQuaid(856-667-7586 or gmcquaid@utrsmail.com)