



SERVICE INFORMATION LETTER

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Subject Guidelines and Standards for Subscribing and Utilizing the Internet-based Engine Condition Trend Monitoring EHM Services

Applicability All Engine Models

This Service Information Letter (SIL) explains the benefits of conducting an Engine Condition Trend Monitoring (ECTM) program, presents the features of Engine Health Monitoring (EHM) Services and provides information on how to subscribe to the service.

The SIL was revised to change the coordinates of the StandardAero office.

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Contains no Technical Data		(X)	
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Definitions

“ECTM” is a process in which changes in certain performance parameters of an engine are analyzed on a regular basis. This is done to help provide early detection of loss of engine performance margin due to wear or malfunction of engine components and accessories in order to minimize unplanned downtime and maintenance costs.

“EHM Services” is the sole ECTM program recommended for P&WC engines in accordance with the applicable EMM or SB. This ECTM program consists of the WebECTM® system or the CAMP EHM system, that use proprietary equations which optimize detection of shifts in engine performance. An integral WebECTM® system module is also available with the TurbineTracker™ System. No other systems are currently recommended by P&WC for this analysis, including previous versions of local ECTM® System IV, ECTM® System V and HECTM System II. Please note that these ECTM® programs have not been supported or updated by P&WC since 2004.

“CAMP EHM” system is the new, updated ECTM program that meets or exceeds the requirements of EHM Services and is considered equivalent, and the preferred option if available whenever EHM Services is required in this document.

“Designated Analysis Centers (DAC’s)” offer professionally trained technicians and expert analysis of ECTM data, regular updates on the status of your engines key parameters and anywhere-anytime access to your data via data management systems TurbineTracker™, WebECTM® and CAMP EHM. For the analysis of ECTM data, operators may contact any of the Designated Analysis Centers (DACs) listed in Appendix “A”.

A professional analyst will be able to properly interpret trend signature characteristics and suggest remedial action for the following anomalies: premature hot section distress, hot start, faulty fuel system, Foreign Object Damage (FOD), bleed air leaks, instrumentation errors and compressor efficiency. Optimized feedback will be realized when the data is inputted, processed and analyzed on a frequent and regular basis.

Alternatively, an operator with in-house expertise may analyze his own data.

CAMP Systems International (CAMP). On January 1st 2011, P&WC entered into a collaborative agreement with CAMP. Under this agreement, CAMP is now responsible for the management of the Designated Analysis Centre (DAC) Network as well as providing technical support and data analysis services to operators previously supported by the P&WC DAC, including P&WC pay-per-hour customers. CAMP expertise and knowledge in web-based services technology will benefit to the future development of their EHM Services application.

The P&WC DAC will no longer be in operation and all operations and historical data will be seamlessly transitioned to CAMP. On expiry of their current contract term, customers of the P&WC DAC will be contacted by CAMP for a renewal offer.

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General considerations and technical recommendations

The following topics, which can be found in Appendix “B”, continue to be valid until the content migrates to the applicable EMM:

- Web-based ECTM Program
- Data Acquisition – In flight, Automatic, Manual
- Data Entry, Normalization and Comparison to Mathematical Models
- Benefits of an ECTM Program

The intent of the following technical recommendations will be incorporated in the appropriate section of the applicable EMM or SB. Content previously found in prior revisions of this SIL is moved to Appendix “C” and will become obsolete when reference to this SIL is removed from the EMM or SB.

- Specific ECTM Guidelines and Standards for engines using ECTM to establish the required HSI frequency.

Operator responsibility:

EHM Services provides operators support in monitoring overall aircraft engine health and means of detecting loss of engine performance margin. As part of these services, operators have the responsibility to regularly provide engine performance trend data and to perform the recommended inspection(s) upon receipt of ECTM alerts. Moreover, to improve the overall effectiveness of the EHM Services, operators should provide maintenance information or feedback to their DAC where applicable.

In cases where engine trend monitoring is required in accordance with Instructions for continued Airworthiness (ICA) or in compliance with the approved aircraft inspection program, operators are encouraged to conduct their own reviews of engine trend data at the recommended frequency for best effectiveness of the program. While CAMP and DAC services assist maintainers in monitoring the airworthiness of their engines, full delegation of ICA or AAIP (Approved Aircraft Inspection Program) trending requirements to these service providers is not recommended

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Where to Obtain Additional Information

If you have any questions regarding this SIL or any other topic, please contact P&WC as follows:

1. P&WC Customer First Centre

US & Canada 1-800-268-8000

International 1-450-647-8000

2. Your local P&WC Field Service Representative

If you have any questions regarding EHM, please contact CAMP as follows:

CAMP Systems International

US & Canada 1-844-CAMP-EHM (226-7346)

International: 1-450-640-3286

E-mail: TrendSupport@CAMPSystems.com

<https://www.campsystems.com/>

For more information on our products, we welcome you to visit our P&WC's Website (www.pwc.ca).

Yours truly,

PRATT & WHITNEY CANADA CORP.



Bjorn Stickling
Manager, Diagnostic, Prognostic & Health Management (DPHM)

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Appendix A

List of Designated Analysis Centers (DAC)

CAMP Systems International, Inc.
2500 Boulevard Alfred-Nobel, suite 301
Saint-Laurent (Quebec)
Canada H4S 0A4
Phone: US & Canada 1-855-CAMP-EHM
(226-7346)
International: (450) 640-3286
Fax: (316) 462-0931
E-mail: TrendSupport@CAMPSystems.com
Web: www.campsystems.com

DETA (Danish Engine Trend Analyzing)
Aaholmvej 22
DK-9870 Sindal
Denmark
Phone: +45 9678 2000
Fax: +45 9678 2001
E-mail: deta@deta-trend.com
Web: www.deta-trend.com

StandardAero
1 Boulevard du 19 mars 1962
BP 50064 95503
Gonesse Cedex, France
Phone: +33 (0) 130185303
E-mail: dacvaf@standardaero.com
Web : <http://www.standardaero.com>

The Trend Group
P.O. Box 642
Clovis, CA 93613-9988
USA
Inside US & Canada Phone: (800) 297-6490
Outside US & Canada Phone: (559) 297-6490
Fax (inside/outside): (559) 297-6499
E-mail: info@thetrendgroup.com
Web: www.thetrendgroup.com

Note: Customers previously with the P&WC DAC are now being serviced by CAMP.

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Appendix B

Note: The following information remains valid until it is migrated to the appropriate section of the applicable EMM (Engine Maintenance Manual).

WEB-BASED ECTM

Benefits of an ECTM Program:

Economics	If performed per P&WC instructions, ECTM may assist in maximizing flying time while minimizing unplanned downtime, delays and cancellations. Monitoring of the engine condition in conjunction with EMM periodic inspection requirements helps the operator to address problems before they have a significant impact on operating cost.
Intervention Planning	Regular trend monitoring of hot section condition and available performance margins in conjunction with EMM periodic inspection requirements provides additional information for the scheduling of repairs and Hot Section Inspection (HSI).
Reduced Maintenance Time	ECTM can reduce troubleshooting time by directing the technician to the general area of the engine requiring attention. Performance recovery measurement versus performed maintenance (e.g. compressor wash) helps identification of the most effective line maintenance practices for operations.
Engine Performance Assessment	ECTM used in conjunction with engine calibration and performance check (5-point calibration) data, provides an additional means of assessing engine performance.

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Web-based ECTM System

An effective Web-Based ECTM program consists of five parts:

1. In-flight data acquisition (manual or automatic),
2. Data entry, normalization and comparison to mathematical models,
3. Data analysis for detection of anomalies (alerts),
4. Alert management and follow-up actions
5. Computer hardware and software with internet connection.

The EHM Services requirements for engines using ECTM to establish HSI frequency are presented in paragraph "Specific ECTM Guidelines and Standards for engines using ECTM to establish the required HSI frequency", the applicable SB or respective EMM (05-20-00, 71-00-00, 72-00-00, as applicable).

In-Flight Data Acquisition

The process to record accurate ECTM data can be located in the General Principles and Interpretation section or User Guide of the EHM Services application on-line help. There are essentially two different systems for data acquisition, manual and automated, with the following general requirements. P&WC recommends the use of compatible automated data acquisition and transmission hardware available through P&WC. This equipment can significantly improve predictive capability by enhancing the regularity and consistency in data recording which may not be the case when undertaken manually due to various engine load factors.

The effectiveness of an ECTM Monitoring program is dependent on the quality of data recorded. ECTM relies on consistent and reliable engine performance data that includes ambient parameters; outside air temperature (OAT), altitude (P.ALT), aircraft speed (IAS) and engine performance data; torque (TQ), engine compressor and propeller (if applicable) speeds (NP/N1, NL/NH/NG/N2), turbine gas temperature (ITT) and fuel flow (WF). It is imperative that the required data is acquired at consistent aircraft operating parameters

People involved in the recording, entry and appraisal of trend data are required to be adequately trained. This also applies to the pilots, if the recording system is not automatic.

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Automatic Data Acquisition

P&WC promotes the use of automatic data acquisition system. Engine performance data is captured automatically by an acquisition system when the required stable conditions are met. When using automatic data acquisition equipment:

- The correct configuration of the automatic data acquisition unit for specific aircraft/engine combination is critical for the data capture. There should be clear procedures established by the operator and adequate training to ensure that the automatic data acquisition system configuration is carried out during replacement of the acquisition unit and during an engine change.
- There should be a procedure to ensure that self/functional tests and maintenance of the automatic data acquisition unit is carried out per the manufacturer's instructions.
- The method and the schedule for the transfer of data from the acquisition unit using acceptable methods are to be specified.
- There should be clear procedures to ensure that once data is acquired that it is sent promptly for data entry.

On certain aircraft applications there may be certain engine parameters which are not visible on the instrumentation panel (e.g. NL speed) which can only be acquired with an automatic recorder. In such cases, P&WC recommends the usage of automated data acquisition and transmission hardware to capture and monitor the non-visible parameters. It must be noted however that if an automatic recording device is temporarily out of service, operators must continue to record the engine parameters manually.

For specific programs, the CAMP EHM system has increased analytical capabilities such as enhanced altitude trending and new Transient Take-off ITT and N2 Margin trending, Compressor pressure ratio trending and main oil pressure trending. Today, these new trending capabilities are available on the PW150 and the PW307/308/306 programs. The capabilities are enabled by the validated data provided by the P&WC FAST system or in some case the engine diagnostic unit.

Manual Data acquisition

Using manual data acquisition, the required data is collected by the flight crew under stabilized cruise conditions and entered on a form dedicated for EHM Services. The following are significant elements of this data collection arrangement:

- There should be clear instructions to the flight crew regarding the flight phase and the aircraft configuration under which data are to be collected. This includes bleeds on/off condition, cabin air recirculation on/off condition, hydraulics and anti-ice settings, as well as some guidelines on the desirable altitude at which data is to be collected. The EHM Services computer program corrects the data for altitude, however it cannot account for the different bleed loads at different

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altitudes. For pressurized aircraft, data collection above 10,000 feet should minimize data variability due to bleed loads.

- The engine(s) should be stable without throttle movement for at least 5 minutes prior to recording the actual values. A mission (preferably the first or last flight of the day) may have to be modified to meet this requirement.
- The actual flight readings should be recorded and not the target values. It doesn't matter if the engines power indications are mismatch. If the data set is consistent, EHM Services will normalize accurately.
- One data set per day of flying is considered adequate. The engine parameters should be recorded first without interruption. Numbers must not be rounded. The aircraft ambient conditions should then be recorded. If applicable, the second (and third) engine parameters should finally be recorded.
- There should be clear procedures to ensure that the forms containing ECTM data are sent promptly for data entry.

Data Entry, Normalization and Comparison to Mathematical Models

Data entry constitutes an area of potential errors and needs special focus as identified by the following elements:

- The ECTM data must be recorded against the engine serial number. It is therefore important to maintain the proper engine configuration in the EHM Services system. There should be arrangements for timely incorporation of engine change data into the EHM Services system.
- Appropriate back-up systems for electronic data should be provided to avoid inadvertent data loss.
- Customized engine model specific trend algorithms are defined by P&WC DPHM in support of engine health trend data analysis. These algorithms are provided to CAMP for incorporation into EHM to support DAC services by means of an interface control agreement. Specific guidelines and instructions are also provided by P&WC DPHM to CAMP pertaining to engine performance trend signatures to assist early detection of engine performance loss characteristics.

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Data Analysis for Detection of Anomalies and Alerts

EHM Services is capable of auto-detecting basic anomalies such as threshold exceedances. However, even with this advanced tool, a professionally trained technician is required to properly assess shifts in trends and recommend remedial action. This professional should be able to interpret trend signature characteristics of the following anomalies: premature hot section deterioration, hot start, faulty fuel system, Foreign Object Damage (FOD), bleed leaks, instrumentation errors and compressor efficiency. Optimized feedback will be realized when the data is inputted (processed) and analyzed on a frequent and regular basis.

For the analysis of ECTM data, operators may contact any of the Designated Analysis Centers (DACs) listed in Appendix A. Alternatively, an operator with in-house expertise may analyze his own data following the guidelines below.

- The ECTM analysis is to be carried out by a person with adequate experience and familiarity with turbine engines that has undergone the Engine Condition Trend Monitoring training. Visit the Flight Safety International training website (<http://www.flightsafety.com/>) for course availability and schedule. Alternatively, on the job training is acceptable, provided the training details are appropriately documented. On line help is also available to customers who have registered with EHM Services
- Data analysis is to be carried out at intervals specified by the applicable SB, EMM or SIL and the findings recorded.
- Policies on resetting the base lines, for example when installing loan/lease engines or following an engine shop visit, should be specified.
- During data analysis, engine parameters should be reviewed for any exceedances when such data is available from automatic data acquisition systems.

For engines using ECTM to establish HSI frequency, please refer to paragraph "Specific ECTM Guidelines and Standards for engines using ECTM to establish the required HSI frequency" or the applicable Service Bulletin (SB) or EMM for additional requirements.

Alert Management and Follow-up Actions

ECTM will help to identify corrective actions based on the trend data.

- The communication of analyst findings, feedback, suggested corrective actions and measures must be documented to demonstrate compliance with the applicable SB, EMM or SIL.
- The maintenance actions are to be performed in accordance with the EMM, recorded and communicated back to the ECTM analysts.

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Hardware and Software

This web-based software is specifically designed to facilitate use and enable rapid intervention. Key features are:

Dynamic Data	EHM Services provides the operator with a global view of data for the entire fleet.
Accessibility	Web-enabled and network-compliant, EHM Services allow multiple users to input and share data from multiple remote locations, at any time. The account administrator will have control in assigning access to service providers and others. EHM Services also allows ECTM records transfer between accounts or to a DAC.
Engine Synchronization	The system may synchronize data for engines installed on the same aircraft.
User-Friendliness	EHM Services displays plots within large graphical displays with a zoom-in feature for viewing specific data. Color-coded data displays and symbols allow users to quickly decipher information. Easy-to-access on-line help is available, displaying information related to the active window.
Turbofan Engine Calibration	EHM Services features a step-by-step engine calibration and performance check (5-point calibration) utility as recommended in section 71-00-00 of the Maintenance Manual. The calculated residual margin data is stored and plots are available for future comparison.

Notes: EHM Services may be used concurrently with the Diagnostics, Prognostics and Health Management (DPHM) Service.

The DPHM Service includes all hardware and software enabling you to perform flight line maintenance tasks such as:

- Downloading engine data and performing Real-time monitoring
- Engine troubleshooting and diagnostic analysis
- Linking faults to the Fault Isolation Charts in the Interactive Electronic Technical Manuals.
- Automated Electronic Data acquisition cellular data transmission systems such as FAST™

Quality Audit:

P&WC DPHM will perform annual Quality Audits on the ECTM tools and services provided by CAMP. The scope of these audits is to verify that the DAC tools are implemented and the DAC services are applied as per the guidelines and procedures provided to CAMP by P&WC DPHM.

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Appendix C

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SPECIFIC ECTM GUIDELINES AND STANDARDS FOR ENGINES USING ECTM TO ESTABLISH THE REQUIRED HSI FREQUENCY

Recommended Starting Point for Monitoring Engine Trends

When approved by the local airworthiness authority and in compliance with the applicable EMM and/or SB, ECTM is to be initiated within the first one hundred (100) hours of operation of a new engine, a newly Hot Section Inspection (HSI) engine or newly overhauled engine.

If the engine trend is to be initiated later than the above requirement, fixed interval maintenance programs will remain applicable. Refer to the applicable EMM for specific engine model instructions. If an engine does not have hard time limits or specific instructions, please contact the P&WC Customer First Centre at cfirst@pwc.ca for support.

Time Frames for Data to be Collected/Downloaded

ECTM data should be recorded at least once every flying day, or once for every six (6) flight hours if the engine is flown more than six (6) hours a day. This data is to be entered (processed) in the EHM Services application at least every seven (7) calendar days or as specified by the applicable Aircraft Maintenance Manual (AMM) or EMM.

Under exceptional circumstances, such as automatic recorder malfunction or adverse flying conditions, a maximum of three (3) consecutive flying days or a maximum of eighteen (18) running hours of missing data is acceptable. The cause of the problem should be investigated promptly and rectified.

Time Periods for Data Review/Analysis

It is recommended that the data be reviewed within a maximum interval of seven (7) calendar days of being inputted in the system.

Qualifications Required for Engine Trend Analysis

Trend analysis is to be performed by qualified personnel who have successfully completed a P&WC approved ECTM / EHM Services course or have demonstrated more than one (1) year of experience using the EHM Services application in conjunction with trend analysis. In addition, they should have

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knowledge of fundamental technical and operating characteristics of the engine(s) being trended. P&WC provides a schedule of EHM Services courses available on Flight Safety International Training website (<http://www.flightsafety.com/>). It is also recommended that qualified personnel follow recurrent training every three (3) years.

Data Interpretation

Reference should be made to the applicable EMM or AMM for guidelines and threshold values when interpreting ECTM data. If the EMM or AMM does not specify any guidelines regarding ECTM data interpretation, refer to the General Principles and Interpretation section of the EHM Services On-Line Help for description, guidelines and interpretation.

Retention of Data and Trending Documentation

Data and supporting documentation is to be maintained by the Operator or the Designated Analysis Center for a period of seven (7) years from date of creation, or until the overhaul of the engine being analyzed, whichever is longer.

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