Trip Report

Development of an Industry Standardized Auditing and Surveillance Tool Prototype

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I. <u>Introduction</u>

This document presents the details of the Kick off meeting held in Memphis on 7th October 2003. It also summarizes the information collected in the first round of interviews conducted by Nikhil Iyengar from Clemson University's Web Tool team on the following day.

The remaining sections of the document are as follows:
  II. Attendees of the Kick off Meeting and Interview Sessions
  III. Notes from the Kick off Meeting and Interview Sessions
  IV. Next Steps

II. <u>Attendees of the Kick off Meeting and Interview Sessions</u>

Attendees from FAA: Barry Englander (FAA), Kip Krebs via teleconference (FAA), Jean Watson (FAA), Jay Wakins (FAA).

Attendees from FedEx: Frank Basile (Managing Director, Quality Assurance), David John, Michael Wilson (Manager, Regulatory Compliance and FAA Affairs), Rocky Ruggieri (Senior Manager, Quality Assurance), Ken Hutcherson (Manager, Aircraft Quality Assurance), Larry McKinnerney (Manager, Aircraft Quality Assurance), John Blaszkowski (Manager, Quality Assurance Technical Audit), Brian Bittner (Manager, Quality Assurance Technical Audit), Bill Williams (Manager, Regulatory Compliance / FAA), Don Taylor (Manager, Information Technology), Ray Nawara (Software Engineer)

Attendees from Clemson Web Tool Team: Dr. Anand Gramopadhye (Professor and Chair), Dr. Joel Greenstein (Associate Professor), Nikhil Iyengar (Doctoral Student)

The Kick off meeting began with a presentation by Dr. Gramopadhye of the Clemson Web Tool team. This was followed by a presentation from FedEx officials. The FedEx officials who presented were (a) Ken Hutcherson and Larry McKinnerney; (b) Brian Bittner and John Blaszkowski; (c) Bill Williams. This was then followed by a presentation on ATOS 2.0 (Air Transport Oversight System) from Jay Wakins of the Federal Aviation Administration (FAA). During the meeting, it was also agreed by the FedEx and Clemson team that, initially, dummy data will be provided on a CD by FedEx.

The following day Nikhil Iyengar met seven FedEx representatives. They were (a) Ken Hutcherson; (b) Larry McKinnerney; (c) Bill Williams; (d) Brian Bittner; (e) Don Taylor; (f) Ray Nawara. He also spoke to John Blaszkowski and collected relevant documents but he was unable to interview John due to a lack of time.

III. <u>Notes from the Kick off Meeting and Interview Sessions</u>

A summary of our notes from the FedEx presentation and the interviews is presented below.

Ken Hutcherson (Manager, Aircraft Quality Assurance) and Larry McKinnerney (Manager, Aircraft Quality Assurance)

Ken and Larry are involved with airframe maintenance oversight. The main objective is to employ their world class Quality Assurance (QA) program. They are in charge of 145 maintenance providers (called 'vendors') and FedEx maintenance crew. Approximately 80% of the maintenance is performed by vendors. The FedEx fleet includes several types of planes including Boeing 700s and DC 10s. They also have an aging aircraft program. The vision which Ken has in mind is to have the ability to perform trend analysis by further improving their current web-based surveillance tool.

Both Ken and Larry are responsible primarily for 'Base Maintenance.' Base maintenance refers to a maintenance event (called MX by FedEx) that takes place over an extended period of time. Line maintenance, on the other hand, refers to a shorter maintenance event. Ken made the analogy of adding gas or performing an oil check is 'Line Maintenance' for a car, while checking the engine is base maintenance.

Surveillance is the continuous monitoring and evaluation of the work contracted to an airframe substantial maintenance vendor to determine the level of compliance with FedEx's Continuous Airworthiness Maintenance Program (CAMP) and General Maintenance Manual (GMM). The primary objective of surveillance is to provide FedEx, through the accomplishment of a variety of specific surveillance activities on a planned and random sampling basis, an accurate, real-time, and comprehensive evaluation of how well each substantial maintenance vendor is complying with the FedEx FAA approved CAMP, GMM, and regulatory requirements.

The step wise surveillance process performed by the QA representative is described below:
A) The process of surveillance begins when a QA representative, stationed at the vendor location, looks at a 'Heavy MX Planning' chart created by the FedEx 'Engineering and Planning' department. For the QA representative, the chart displays various aircraft coming into that location over a period of 90 days. Ken has a similar chart. However, Ken's chart shows various aircraft coming into all vendor locations.
B) The QA representative reads the chart to determine which aircraft will be coming in the following week. These aircraft are represented by their unique aircraft tail numbers.
C) The representative enters one of the tail numbers into the web-based 'PCS work Package' available on the FedEx intranet.
D) This action displays the work order numbers related to the aircraft. A work order number refers to work already done (historical data) or to be done on the aircraft. The work order number is unique. On rare occasions, there may be multiple work orders pending for an aircraft. This would happen when an aircraft has been recently purchased and is undergoing a conversion

process. The representative notes the work order number on a sheet of paper. The system does not have the ability to transfer this number to allow the representative to perform his next task.

E) The representative then logs into an 'On-line Surveillance system' on the QA intranet and selects 'Surveillance Scheduling' to schedule a surveillance of the incoming aircraft.

F) On entering the work order number that the representative had noted down, a list of work cards to be followed for that aircraft are presented. A work card refers to a specific task to be performed on that aircraft. A work card number is unique for a particular aircraft type (such as a DC 10, MD 10, MD 11, A300, A310 or Boeing 727). The system selects 10% of the total number of work cards for that work order number. Any work card that has not been selected for an audit in the past 90 days is a candidate for selection. Ken can add additional work cards to be reviewed by the QA representative using the same system. The representative can also perform surveillance on other work cards which are not included in the surveillance schedule.

G) The representative imports the schedule into an Excel file and prints it out for the vendor.

H) The vendor enters the required dates for each work card and returns the document back to the representative.

I) The representative thus knows the date for each of the work cards on which he plans to perform surveillance.

J) After each audit, the representative enters his results into an online 'Surveillance Activity' form available in the Surveillance system. Thus, for every maintenance card on which representative performs surveillance, there is a surveillance activity form that is completed and submitted to the database. The representative qualifies each surveillance as "Accept," "Reject," or "Other." Accept refers to all those surveillances which agreed with the inspector's judgment. Reject refers to a disagreement between the representative and the inspector. It is this reject which is later used by Ken and Larry to evaluate how efficient a vendor location is. Other refers to a result when the representative cannot accept or reject. Ken pointed out that this could be related to FedEx procedural issues. Certain work cards may result in certain non routine procedures each of which is assigned a non routine number. 'Other' results in the generation of a WCCR (Work Card Change Request) or a PFCR (Publication Form Change Request). The PFCR is not shown in the current system.

The FedEx representative performs and documents the surveillance activities (listed below) in a systematic fashion to ensure the substantial maintenance vendor he/she is assigned to, is complying with the intent and letter of the FedEx CAMP and FAA regulatory requirements. Next to each of these activities, the specific task reporting categories to which they belong have been provided in parentheses. The task reporting categories used by FedEx are "T" = Technical; "P" = Programs; "A" = Administrative; and "H & F" = Housing & Facilities.

A) **In Process Surveillance (T)** – The act of observing a maintenance task that is currently in work. The FedEx On-Site QA Representatives will select certain work cards, EO's (Engineering Orders), and EA's (Engineering Audits) and observe the task being accomplished by the vendor mechanic or inspector to ensure competency, correctness and that the FedEx

paper work is adequate to complete the task. This surveillance should be performed progressively throughout the maintenance event.

B) **Verification Surveillance (T)** – The re-inspection of completed work cards, EOs, EAs and SNRMs (Non Routine Maintenance) that are signed off as complete. No additional reopening of access panels that have been closed or disassembly of the aircraft or assistance from vendor personnel will be required unless poor workmanship or other conditions are evident during the surveillance. This surveillance activity is to ensure that the intent of the task has been complied with, the workmanship meets acceptable standards and that the FedEx paper work is adequate to complete the task. This surveillance should be performed progressively throughout the maintenance event as the tasks are completed.

C) **Final Walk Around (T)** – A general surveillance of the aircraft at the end of the scheduled maintenance event, usually after the vendor has completed the work scope assigned, that checks the general condition of the aircraft. Example: obvious safety, legal fitness, airworthiness items, general condition, cleanliness and completeness of the aircraft, especially the cockpit, lavatory, courier area and cargo compartments, landing gear wheel wells, all access panels properly installed and no indication of fuel, oil or hydraulic leaks. Proper completion of the aircraft logbook is also be included in this activity.

D) **Aircraft Walk Around (T)** – This surveillance category is to be used only for those technical findings that cannot be traced to a scheduled maintenance task that is on the current work scope for the scheduled maintenance event. Every attempt is made to ensure that the finding is not part of the scheduled event prior to using this category.

E) **Quality Control (P)** – Surveillance that ensures the vendor is complying with the requirements of the CASE 1A standard section 2.

F) **Inspection (P)** – Surveillance that ensures the vendor is complying with the requirements of the CASE 1A standard section 3.

G) **Technical Data Control (P)** – Surveillance that ensures the vendor is complying with the requirements of the CASE 1A standard section 4.

H) **Shelf Life Control (P)** – Surveillance that ensures the vendor is complying with the requirements of the CASE 1A standard section 5.

I) **Tool and Test Equipment (P)** – Surveillance that ensures the vendor is complying with the requirements of CASE 1A standard section 6.

J) **Housing & Facilities (H&F)** – Surveillance that ensures the vendor is complying with the requirements of the CASE 1A standard section 8.

K) **Safety/Security/Fire Protection (H&F)** – Surveillance that ensures the vendor is complying with the requirements of the CASE 1A standard section 9.

L) **Storage (P)** – Surveillance that ensures the vendor is complying with the requirements of the CASE 1A standard section 10.

M) **Work Processing (A)** – Surveillance that ensures the vendor is complying with the requirements of the CASE 1A standard section 11.

N) **GMM Compliance (A)** – Surveillance that ensures the vendor is complying with the requirements in the FedEx GMM.

O) **IPM Compliance (A)**

P) **Information**

Q) **Fuel Surveillance (P)**

The QA group uses these 17 activities to calculate the percentile rejection rate on each task reporting category. This is then provided to the directors on a monthly basis. The details of the work flow are available in the 'On Site QA Representative Desktop Procedures Manual.' This document has been made available to the Clemson team as a soft copy on a CD.

Bill Williams (Manager, Regulatory Compliance / FAA)

Bill is responsible for the Air Worthiness Directive Control Group (ADCG). Their main goal is to implement AD in the maintenance system. As many as 800 ADs are created monthly. The step-wise process for conservation and implementation of an AD into the system by ADCG is described below:

A) ADCG reviews the Federal Register (FR) each day http://www.gpoaccess.gov/fr/, including weekends and holidays, for new, revised, or corrected ADs that could be considered initially applicable to aircraft, engines, or appliances operated by FedEx. Almost every day the FR issues an AD.

B) If the "applicability statement" of an AD refers to an aircraft model and series or engine model and series operated by FedEx, or if the AD addresses an appliance or component that could be installed on an aircraft operated by FedEx, the ADCG considers the AD to be initially applicable.

C) For those ADs which are considered applicable, the ADCG imports the AD from the FR into an Engineering Authoring System (EAS).

D) The upper portion of the AD Notification Transmittal (ADNT) form is completed by the ADCG group which includes a complete description of the AD. ADCG forwards a copy of the ADNT to the appropriate engineering manager and one to the Aircraft Records where the AD number and the subject are loaded into the Modification Control System (MCS).

E) The engineer completes the lower portion of the ADNT and indicates the document, such as Engineering Order, Engineering Authorization or Fleet Campaign Directive (FCD), to be issued to accomplish the AD requirements. Generally, an EO is issued when an AD affects several aircraft types. An EA is issued for a particular aircraft type. An FCD would be issued to carry out inspections. However, if while conducting an FCD a crack is found then an EA or EO may be generated. Several EOs may be generated from one AD. For every AD, an EO generates some number of work cards referred to as "dirty finger prints" by Bill. Bill also pointed out that not only ADs, but also engineering changes could result in an EO or EA. For example, an Engineering Order Change Notice (EOCN) is generated when a new aircraft is acquired.

F) Each AD process can be tracked using the AD Management Tracking (ADMT) form, which is a table where each row represents a task to be carried out in the AD process. If a date is missed, the system automatically sends an email to Bill who takes up the matter with the responsible person.

Bill provided various documents for our review such as the AD Procedures in GMM, copies of ADNT, ADMT and EOCN forms, Engineering Order and Work Instruction Cards.

Brian Bittner (Manager, Quality Assurance Technical Audit)

Brian is responsible for the Quality Assurance of Technical Audits. His job function includes performing two audits:

A) Supplier Audits: The mission of the suppliers' audits is to verify that non FedEx aircraft maintenance support activities and suppliers who perform aircraft, engine and component maintenance, preventive maintenance, alterations, modifications and required inspections on aircraft meet the requirements of applicable Federal Aviation Regulations, FedEx policies and procedures and various industry standards. The various categories of suppliers are:
   a. Substantial maintenance vendors (airframe, engine, safety equipment) as defined in FAA HBAW 96-05C
   b. Component overhaul and repair shops/ Manufacturer's Maintenance Facilities (MMF).
   c. Surplus part suppliers, dealers and distributors.
   d. Specialty suppliers (plating, machining, etc.).
   e. Tool calibration suppliers.
   f. Aircraft new parts distributors.
   g. Engine maintenance suppliers (components and/or modules).
   h. Manufacturers of parts made for FedEx (FedEx OEM).
   i. CASE (Coordinating Agency for Supplier Evaluation) Allocations.

   j. International Airline Technical Pool (IATP).

   For such audits Brian has 4 auditors, who cover both the United States and other countries. These audits take most of Brian's time.

B) Fuel, Maintenance and Ramp Operations (FMR) Audits: The mission of the Fuel, Line Maintenance & Ramp Operations Audits workgroup is to provide oversight of functions relating to aircraft line maintenance, ramp operations and aircraft fueling, whether FedEx owned or contracted. This is accomplished by a formal system of technical audits performed by qualified FedEx Senior Technical Auditors. Most of these audits are performed by other airlines as well. A sample of areas audited include:
   a. FedEx trunk ramps: Ramps refer to the various loading and unloading of shipments performed on a daily basis.
   b. Line maintenance locations (FedEx and vendor)
   c. Fuel storage and servicing activities (FedEx and vendor): This refers to activities related to the quality of the fuel at the airport.

During his presentation at the Kick Off meeting, Brian presented a flow chart depicting how he performs his audits. This begins with identifying an audit. This could happen by an email request or a phone call to Brian from any department. Brian may also receive a request from SCORE (Supplier Capability and Operational Reporting). SCORE is a mainframe program which can be accessed by various departments in FedEx. This 'Repair Supplier Maintenance request' pertains to a particular supplier or supplier type. Regardless of the type of audit, the basic sequence of tasks performed for an audit remains the same. Based on the zip code, Brian will assign an auditor and schedule an audit by forwarding the request to the assigned auditor. The auditor will select the audit standards, perform pre audit analysis and finally complete the audit. The auditor then reports the findings to Brian. This results in a document on 'Corrective Actions.' Note that these audits are recurrent. The time taken for an audit depends on the nature of the audit being performed (e.g., Ramp audit take about 12 months per audit). Details on the distribution of audit frequencies are provided in the 'QA Technical Audits Desktop Procedures Manual.'

Brian also mentioned that some short and simple audits such as calibration and specialty suppliers are conducted as 'Mail-out Audits.' In such cases, the audit form is mailed out to the supplier for completion. A database of suppliers approved for use in the maintenance, preventive maintenance or alteration of FedEx operated aircraft, engines and appliances is maintained in the Maxi Merlin computer system. Only these suppliers may be used for such maintenance operations. Maxi Merlin is the Data Warehouse for FedEx where all audits are tracked. All aircraft maintenance information is stored in Maxi Merlin.

For Supplier Audits, the recurrent audit frequency varies between 12-36 months. Auditors determine the next audit date after analyzing a variety of factors such as (a) Supplier type; (b) Reliability data; (c) Supplier usage; (d) Previous audit findings; and (e) Business needs and limitations.

The details of the work flow are available in the 'QA Technical Audits Desktop Procedures Manual.' This document has been made available to the Clemson team as a soft copy on a CD.

Don Taylor (Manager Information Technology) and Ray Nawara (Software Engineer)

Don and Ray provided various documents which list the tables used for surveillance in the database. Don also listed the hardware and software configuration used by FedEx. Hardware used is HP and Sun. The operating systems are Unix and Linux. The Database used by FedEx is Oracle. Software used includes Web Logic, Apache Web Server and JDK / J2EE. FedEx uses both the Netscape and Internet Explorer browsers.

IV. <u>Next Steps</u>

The issues the Clemson web tool team will address next include:
1) Identify the methodologies to be applied to identify impact variables.
2) Identify a list of impact variables (including the impact variables used by FedEx).
3) Prepare a plan for the next set of study sessions to be conducted and identify the stakeholders to involve.
4) Forward any questions to FedEx that arise while studying the information gathered.