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INACCURATE OR MISSING DATA

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COSTLY LOSSES

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- Capturing incorrect data points on a delivery estoppel can result in paying out more than required
- Missing or unusable records can mean necessary additional major maintenance which can be as much as $20-30M on a Boeing 777
- Inadequately capturing lease provisions can result in the loss of millions of dollars for a lessor

Avoid Costly Losses By Ensuring Accuracy of Your Vital Data

Zeevo Group explores the ever-expanding data requirements within the aviation industry, and how to ensure the accuracy, efficiency, and efficacy of your leasing company's vital data to prevent any outsize impact on your financials.

Sweeping regulatory mandates such as Sarbanes-Oxley (SOX), higher levels of scrutiny and rapidly evolving markets, are making capturing and processing data for aircraft lessors more crucial to success than ever.

Inaccurate or missing data can have an outsized impact on an aviation leasing company's financials. A few common and costly examples include:

- Remarketing aircraft with the wrong maximum take off weight (MTOW) can cost millions to upgrade;
- Capturing incorrect data points on a delivery estoppel can cause miscalculations on a component's maximum top-up exposure, resulting in paying out more than what is required;
- Missing or unusable records can mean having to re-perform major maintenance on aircraft to remarket it. This can be as much as $20-30 million on a Boeing 777; and
- Inadequately capturing lease provisions, such as end of life (EOL) compensation mechanisms, can result in the loss of millions of dollars for a lessor.

Zeevo Group Principal John McCartney puts it succinctly: "Better data means better results." This is certainly true, but leveraging the full power of your data is difficult when you're inundated with it. "It sometimes seems that there is an infinite volume of data required to keep up-to-date information on a single aircraft's technical specifications—let alone a whole fleet of aircraft. Yet employee time is a finite resource," claims McCartney.

The value of accurate data is beyond question, but the extraction, entry, management, and integration of data is both time consuming and fraught with risk. The difficult question for any leasing company is:

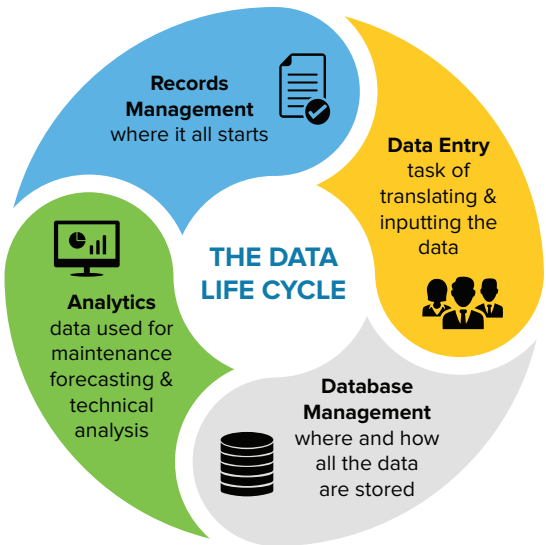
> *"How can we efficiently capture all of this information while maintaining impeccable accuracy, efficiency, and efficacy?"*

When it comes to data management, efficiency entails the useful energy, time and money spent entering and storing data, while efficacy entails the ability of using it to produce the best results. And then there is accuracy. A company can be efficient at data entry, but if the information is erroneous or inaccessible, how much value does it really have?

It is a difficult balancing act to process data with alacrity while ensuring both precision and worth. Plenty of obstacles may impede your company, but given the right tools and procedures, you can overcome these data bulwarks to achieve the intended outcome without integrity or speed loss.

The Data Life Cycle

In capturing the current technical status, projected maintenance cash-flows and asset appraisals for a fleet, there are four principal stages in the data life cycle:



Zeevo Group is well equipped to meet the challenges presented in each of these stages, applying leading-edge processes across multiple systems and platforms. The Zeevo team has faced the difficulties that this involves, and has members with the specific skill sets to ease the burden of data management, so your employees' time is spent fulfilling their primary responsibilities.

Records Management

To best understand the optimal use of data for an aircraft leasing company, one needs to start at the source: the documents.

On any given day, an aircraft lessor can receive or produce countless quantities of vital documents. These

include utilization reports, technical specifications, Life Limited Part (LLP) disk sheets, contracts, delivery estoppels, original equipment manufacturer (OEM) manuals and original certificates—the list goes on. Drill down on any of these, and there are more subcategories.

For instance, CofAs and critical maintenance records include maintenance reserve claims with invoices, work scopes, certificate of release (CRS), task cards, etc. With so many records, even the most unflappable data manager can feel inundated and overwhelmed.

And, as anyone who has worked in technical knows, documents can come in a wide array of formats and structures—often with minimal consistency across an entire fleet. Even the file types—PDF, Word or Excel—can vary depending on the source. It is not unusual to have inconsistent formats coming from the same source. As for scanned documents, how many times have you opened a scanned file only to discover that the most crucial information was illegible?

Given the quantity and variety of documents, tracking and storing them can be a headache, but it remains an essential task for an aviation leasing company. The process by which a company does this task is not only important to the people responsible for data entry, but also for mitigating risk and minimizing control deficiencies when auditors come to town. (SOX controls, anyone?)

"By having a defined records management procedure in place, important stakeholders for a given document will enjoy increased visibility of when it was received, and can more easily retrieve it when requested by other parties."

With regard to improving efficiency, a well-defined records management procedure involves several key steps and functions:

Specifying Your Methodology

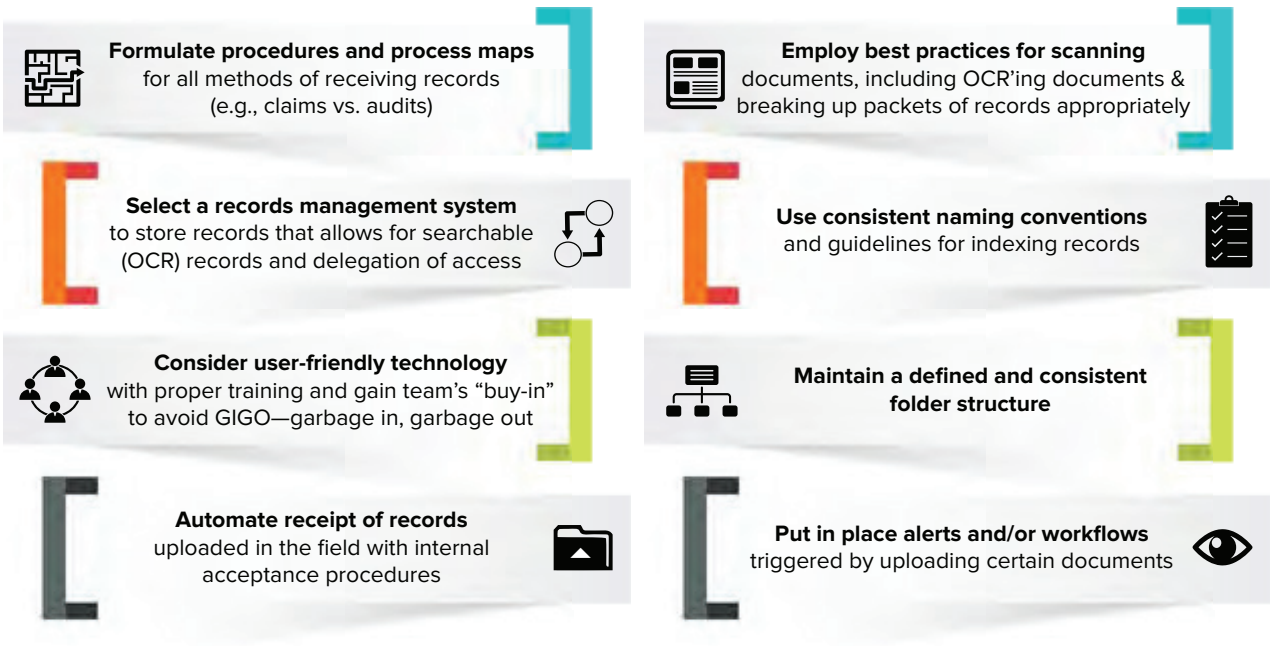
The first thing to consider is whether an all-encompassing, uniformed set of guidelines and procedures should be applied to all fashions of records received. Does it really make sense to apply the same methodology for technical records as with legal or contractual ones?

It makes more sense to define distinct approaches that are dependent on the type and purpose of the record. In doing so, a company can be more agile when accommodating the disparate requirements for varying records.

Of equal importance is the selection of an optimal records management system for a company's needs. These management systems are two-fold. One is a document management system for internal storage of records. The other is a maintenance records system to upload records from external sources.

When selecting a records management system, some key points include:

- Document control and versioning;
- Ability and ease of managing access. Can it control access rights for folders by department team members? What about permissions for external parties such as auditors or potential follow-on lessees?
- Security;
- Storage size—how much digital storage space is needed? Keep in mind that a ten-year-old aircraft may have over thirty cardboard banker size boxes of records;
- For maintenance records, is the system stable enough to support the FAR Part 121, Section 121.380 maintenance recording requirements?
- Indexing and use of meta-data that enables ease of filtering and searching for documents; and
- Ability to be integrated with a company's other systems, and initiate workflows when documents are uploaded.



File Organization

For routinely received records, such as utilization reports, having a portal that allows lessees to **directly enter consistently formatted data into a system**—where it can be accepted or rejected (i.e. returned for corrections)—grants visibility to multiple stakeholders while keeping a consolidated track record of the information received.

Furthermore, upon acceptance, the data can then feed into an asset management system for billing and asset status updates. This may also cover a company's internal controls as the data comes directly from the lessee and is never re-typed.

Efficient scanning of documents starts with the selection of hardware and software. Choosing those that produce clean images and automatically OCR documents saves time down the road. Assembly line tactics, where one scans multiple documents at once, separated by identifiable header pages that can then be broken out once in PDF form, are a helpful practice for efficiently capturing large packets of records.

Consistent naming conventions for files and pre-defined folder structures enable relevant stakeholders to easily locate and retrieve documents. A strong naming/categorization convention for a file should contain:

- the date of the document;
- the MSN;
- component serial number, and/or operator it is associated with; and
- the type name of the document (e.g., disk sheet).

These type names are best when pre-defined, including any caveats regarding the variations of the type (e.g., pre-shop visit disk sheet vs. post-shop visit disk sheet).

Consistent folder structures across aircraft or operators ensure that regardless of the MSN, the same document types reside in the same sub-folders.

When **defining record management procedures and implementing record management technologies**, a company should always account for how user-friendly these are. To reap the benefits of these procedures and technologies, employees must be properly trained in how to use the technologies, and procedures must not be too arduous for employees to reliably follow. Systems and procedures that are too laborious become a disincentive for employees to adapt to them. Finding the right equilibrium can optimize the organization of a company's documents.

Data Entry

Having a well-defined Records Management procedure is essential, but all that information has limited use until all the relevant data is extracted and entered into a repository (e.g., an asset management system). After all, who has the time to continuously reference source documentation every time he or she wants to know a handful of data points? While data entry is certainly not the most glamorous aspect of a company, it is one of the most vital cogs for supporting those gears that drive analysis and management decision.

Exploring ways to automate data entry process using data mining from records, lessee portals with direct feeds, and record repositories that may auto-detect record types and appropriate naming conventions, can reduce time and money spent on data entry. The future is now, and technologies are evolving to manage this.

Whether for large scale projects or routine tasks, data entry is a time consuming and often mundane responsibility. Many people have gotten their start within the aviation industry through data entry positions, so it's not hard to find "war stories" of people punching keys and taking names. As these unsung heroes can likely attest, one can get into a groove when keying in data. Nothing can upset that groove more than constantly having to eyeball validation checks and draft related correspondence. Most data entry roles can be summed up by, "How can I do this faster and better?"

When it comes to entering utilization reports or technical specifications, the speed at which the data is entered only matters if it is accurate. Incorrect data entry adversely affects proper invoicing, re-marketing of assets, cash-flow projections, and asset valuation, as well as numerous other areas that impact a company's bottom line. The question is, "how can data be entered or collected in a timely fashion, while ensuring accuracy and keeping the relevant stakeholder apprised of any pertinent information?"

With the use of automated alerts, detective controls, integrity checks, and portals for direct entry, data capturing tasks can be compartmentalized to focus more energy on the actual inputting and collection of data. Such features can free up more time for valued employees to spend on other responsibilities.

Data entry takes on many forms, but to illustrate the use of these features the focus here is on utilization reports and LLP disk sheets.

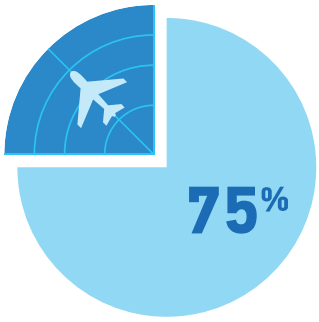
Utilization Reports

Entering utilization reports is a monthly activity for an aircraft leasing company. These reports are used for maintenance reserve invoicing and maintaining an up-to-date status on an aircraft. They are pertinent to the Technical department, which uses them to track the status of an aircraft. The Accounting department, uses them to

monitor cash-flows and the Marketing department needs them to have the latest and greatest information when pitching an aircraft or engine to prospective lessees.

A utilization data manager has assisted with data entry for a globally recognized aircraft lessor. For a batch of 50 aircraft, she has estimated that it would take around eight continuous hours to just enter the data if no time were spent on validations, reviews, and correspondence.

However, for her typical process she contends that only 75% of her time is spent on entry, with the other 25% spent on validations and correspondence.



That means she is handling roughly 13 fewer aircraft per day than if she had focused more explicitly on entry. So, what exactly is slowing her down and how can it be remedied?

Starting at the beginning, as previously detailed, a lessee portal for the direct entry of requisite data points into a system with follow on workflow triggers limits the manual re-typing of monthly and total utilization by component for a lessor. The workflow increases visibility for when a utilization report has been received, allowing for quicker acceptance or rejection of the data into an asset management system.

Alerts and Detective Controls

When reviewing a new utilization report, alerts and detective controls can inform the enterer or reviewer of any important details from the previous month's utilization. This can go a long way in interpreting any anomalies on the current month's report. For example, if the reviewer sees an alert that an engine had accrued zero utilization in the previous month, it would help explain why there was zero utilization reported for the current month, reducing the need to investigate further.

On the flip side, if the reviewer received the same alert, but the current month's report does show utilization on the engine, then the reviewer knows that the engine is no longer grounded, and the relevant parties can be informed.

Speaking of informing the relevant parties, with the use of alerts, a reviewer can note important status change information in the asset management system and have the relevant stakeholders immediately alerted to the change without having to draft a correspondence. For instance, if a utilization report notes that an engine has been inducted into the shop or shows zero utilization, then alerts can be used to automatically inform the applicable technical team member, which in turn gives that person a head start in determining the status of the engine.

Analogous features can also be used to notify the reviewer when monthly utilization accruals on non-airframe components (e.g., engines, landing gear, APU) do not align with the airframe's accrual for the month. Notifying the reviewer of discrepancies between a given component's accrual compared to the airframe to which it is contractually associated can assist in determining the location of the component. These component accrual discrepancies can mean that the component has been removed for maintenance, but can also be indicative of when it is attached to a different airframe. Informing the reviewer and/or using alerts to notify the applicable Technical department stakeholders of these types of discrepancies enables them to get ahead of the game in determining the component's status and location. If not already noted on the utilization report itself, the relevant stakeholders can use this information to reach out to the operator to see if the component has been removed for maintenance or if it was attached to a different airframe.

Detective controls and integrity checks can also be used to identify abnormal utilization that can be difficult to catch by just eyeballing the report. Over time, historical trends of flight hour (FH) to flight cycle (FC) ratios can be leveraged to identify abnormalities in a utilization report. If the data entered has a statistically significant variance in the FH to FC ratio compared to historical trends, then detective controls can be used to alert the reviewer and/or relevant stakeholders that there may be an error in the utilization report provided.

Comparable checks can be used to inform the reviewer of what a component's Time Since New (TSN) and Cycles Since New (CSN) should be based on the accrual entered. This calculated TSN/CSN can then be compared to the TSN/CSN detailed in the utilization report. If the variance is beyond a material threshold the reviewer can then note this, immediately informing the relevant stakeholders of the discrepancy.

The materiality threshold should be defined by the Technical department, but a reasonable threshold can commonly be a margin of five FHs and two FCs.

None of these alerts, detective controls, and integrity checks can eliminate the need for an eyeball review and validation of the data. However, they can eliminate manual re-entry of data by multiple parties, assist in diagnosing the cause of incongruities, and in recognizing outstanding issues without having to spend time performing exhaustive and redundant checks each month. Having more context made easily available improves the efficiency of validation reviews; thereby freeing up time for employees to move on to the next task.

LLP Disk Sheets

Engine maintenance is expensive. Spending $3 million on replacing an entire LLP stack too early just because there was not enough information available is not acceptable. Accurately tracking an engine status at the LLP level is essential to effectively managing a company's assets.

Inputting LLP disk sheet data represents one of the more intricate and involved data entry tasks that an aviation leasing company faces. An engine can have anywhere between 15 and 75 (depending on the inclusion of fan blades and/or annulus fillers) individual LLPs reported on a disk sheet. As listed below, each of these parts requires entry of several distinct data points on top of the high-level metadata for a disk sheet. These data points include:

- Disk sheet date;
- Disk sheet type or source (e.g., post shop, delivery);
- Engine TSN and CSN;
- LLP name (e.g., Booster Spool);
- Engine module (e.g., High Pressure Turbine (HPT);
- LLP part number (PN);
- LLP serial number (SN);
- LLP life limit;
- LLP FCs consumed; and
- LLP Cycles Remaining (CR).

Further complicating matters, given that certain engines can operate at different thrusts (which can also mean varying life limits per LLP), the last three data points may require entry for each applicable thrust level. All told, this can mean that over a hundred data points must be captured to enter a single disk sheet.

For instance, a CFM56-7B engine variant (which is the engine variant associated with globally popular Boeing 737 Next Generation aircraft) typically includes 18 individual LLPs. If operated at only a single thrust, then there could be 126 data points to capture not including the disk sheet metadata. If operated at two separate thrusts, however, that number can balloon to 180 data points (54 additional data points to capture the life limits, FCs consumed and CR for each additional thrust rating).

Given that LLPs can be one of the costliest maintenance expenses—replacing the entire LLP stack on a CFM56-7B variant would be in the $3 million range—it is essential to ensure the accuracy of the data entry.

Relying solely on one party to enter the data and perform eyeballed validations can be both inefficient and ineffective. So what can be done to mitigate the risk of false entry?

Potential Solutions

One method is the use of a double entry mechanism, which for these purposes can qualify as a form of integrity check.

A double entry mechanism is a process in which data for the same disk sheet must be entered twice and be consistent across both entries before being considered valid. With so many data points requiring input, it is easy for human error to occur during entry, but it is unlikely for the same error to occur by two different people.

Double entry mechanisms can identify any incongruities between the two entries, forcing both parties to come together to reconcile the cause of the mismatch and rectify the error before the disk sheet can be considered valid and finalized. While double entry can be time consuming, it represents one of the most fool-proof procedures for ensuring the accuracy of data entry and complying with a company's documented controls.

As with utilization reports, similar tools can be used to inform relevant stakeholders of major status changes and discrepancies resulting from the entry of a new disk sheet. One such tool, from a data entry perspective, is the use of calculated CR estimates derived from the engine's CSN, which can be used to cross-reference against the CR reported in the disk sheet. If a previous disk sheet on an engine already exists, then, in theory, the CR for the current disk sheet should equate to the CR from the previous disk sheet minus the delta of the current disk sheet's engine CSN and the historical ones. Alternatively, if no previous disk sheet exists, in theory, the CR should equate to the life limit minus the engine's CSN. By having calculated CR estimates available, the enterer can more easily identify potential discrepancies that require further investigation. These discrepancies can be an indication of an error in the actual disk sheet provided, the replacement of an LLP, a change in operating thrust, and/or an extension of an LLP's life limit compared to the last recorded disk sheet. Without a CR estimate, it can be nearly impossible to identify irregularities in the latest disk sheet—like finding a needle in a haystack.

Additionally, detective controls that compare the last recorded disk sheet against the current one being entered can assist in uncovering possible engine shop visits that were previously unknown. This can be of particular use with non-reserve payers that are not as forthright regarding an engine's status. This control would work by simply identifying LLPs that have a higher CR than previously recorded. If this scenario were to arise, the relevant stakeholders could be automatically alerted to the status change, thereby giving them a heads up to reach out to the operator to confirm the engine's status.

The alerts, detective controls, and integrity checks illustrated here (along with others not directly referenced) can come from several sources. Some may already be out-of-the-box features in your company's platform that only need to be enabled. Others may require the creation of workflow procedures and protocols. And others still may require the use of third party reporting tools (i.e., business intelligence). Whatever the case, the implementation of these tools can greatly reduce the energy spent on data entry and review, while maintaining a high degree of accuracy. It can also provide visibility of an important status change and any discrepancies in need of further investigation.

Looking forward, instead of performing data entry, why not go straight to the source? Developing integration solutions between a lessor's system and an airline or MROs maintenance planning system, may enable the requisite data to be shared instantaneously; thereby eliminating the need for duplicate entry.

Database Management

Data entry is needed to capture relevant information, but, no matter how efficiently and accurately it is entered, that data bears no fruit unless it is made accessible. Most aviation finance companies start out using spreadsheets to track their asset and contract information. As a company's fleet size grows, so does the number of transactions that must be managed. The larger the fleet size, the more difficult it is to track the asset and lease information solely through spreadsheets.

Relying on spreadsheets can also increase the risk of operational errors. If the wrong version of a spreadsheet is distributed or there is an error in a cell formula, then a company may under bill for maintenance reserves. The more transactions a team needs to process, the more error prone the process becomes. Accordingly, most company's eventually purchase a (transactional) asset management system that relies on an underlying relational database. Whatever the system, the data entered will be stored in one of these databases. How that database is managed and how the data within is extracted—either through the system's out-of-the-box reports or data analytics tools—is key for delivering effective management reporting.

Making the decision to purchase or even develop a customized asset management system is just the first step. There are still many pitfalls that can inhibit the full realization of a company's substantial investment in one of these systems. Well-defined business processes, and a clear understanding of where a new system fits in with those processes, is crucial to successful implementation.

Another important decision is: "Should a company load all of its historic data?" Other targeted decisions, such as a defined, consistent approach in naming conventions and input processes, all contribute to the quality of data records—enabling the ability to re-use and integrate the data with other systems across an organization.

It is essential that the chosen asset management platform can easily integrate with third party reporting and business intelligence (BI) tools. Given employees' competing priorities (i.e. primary responsibilities vs. implementation and optimization tasks), a project such as this may appear too daunting for an aviation finance company to tackle without a dedicated team that includes employees supplemented by outside resources.

An experienced implementation team can go a long way in avoiding the common pitfalls of this process and maximizing the technology investment. The effort involved in migrating data to an asset management technology should not dissuade a company from embarking on the journey.

The benefits can greatly outweigh this effort and can immediately pay dividends, including the continuous time saving benefits.

Data Extraction

One of the most frustrating obstacles that aviation leasing companies encounter is the inability to extract their data from multiple sources in a meaningful way. Many systems used in the aviation leasing industry today have built-in reporting features, but often times the system-generated reports do not sufficiently cover the requirements of the relevant stakeholders. BI solutions can be leveraged to get the data out, extend the bare-bones reporting capabilities of enterprise applications, and apply visualization and analytic capabilities to the underlying data. A BI solution can sometimes be as simple as using Excel templates that take pre-exiting reports to slice and dice the data, presenting the information in a more meaningful way. Excel templates can also be used to derive additional information not explicitly included in pre-existing reports.

However, there are also several BI platforms available that far exceed the capabilities of Excel. These BI solutions can be highly customizable to meet any company's requirements and are powerful tools in extracting data from a broad array of sources to consolidate it in a meaningful way, which can give a company a competitive edge.

BI solutions are ultimately dependent on the integrity of the raw data and data stores, but by maintaining clean data, the implementation of BI solutions can extract a company's data for boundless applications. BI solutions can empower innovative new ways of understanding data to reduce costs and maximize revenue and efficiency.

Looking Forward to "Big Data"

Despite seeming like there is an immeasurable quantity of data, currently, the relational databases used by most aviation leasing companies are modest in size. All in, these databases may only consist of a few hundred gigabytes of data, but with the rise of "big data" sources, aviation companies may be looking at whole new magnitude of data (i.e. petabytes).

"New technology aircraft can produce reams of data with applications that are filled with possibility."

According to *Aviation Week & Space Technology*, the opportunity associated with a connected aircraft could be one of the most significant advancements in aviation's history. We are just beginning to understand all that can be done with 'big data' from aircraft. In fact, we are facing a plethora of possibilities for which the aircraft leasing community has not yet envisaged real-world applications.

One of those possibilities may be live access to an engine's LLP status, rendering that arduous and risky data entry task moot. The ultimate benefit may be live access to every component's status, so no more utilization reports. Think of the time that could be saved.

The use of "big data" is still in its beginning stages—within the aviation industry it is mostly limited to airlines and MROs. But as with any new technology, it is likely that leasing companies will one day have the capability to incorporate "big data" to maintain a competitive edge.

Analytics

There is inherent value in the optimization of the three steps in the data life cycle mentioned above, much of which should be self-evident. But ultimately some of the most significant benefits are how that data can be extrapolated and manipulated to perform advanced analytics. Whether for historical trend monitoring, maintenance projections and cash-flows, asset valuations and/or other analytics not contemplated here, any analysis is only as good as the underlying data and its accessibility. However, optimizing your data using the three steps above, unlocks a cornucopia of abilities in this all-important fourth and final phase of the data "life cycle."

Successfully capturing, inputting and storing this mountainous quantity of data enables your company to devise robust and nuanced analytical models. What follows are a few examples of how this data can be used, justifying the time and energy spent getting it to this point.

Historical Trend Monitoring

By continuously gathering and inputting high-quality data over time, this data can be used to derive historical trends, which can then be used for establishing baseline assumptions and predictive modeling. Reaching back to utilization reports, the information entered—in conjunction with the methods for managing databases—can subsequently be used to determine the average annual FH and FC utilization of an aircraft as well as the average FH to FC ratio.

Establishing a baseline assumption of the average FH and FC utilization for a specific aircraft or aircraft type is a quintessential component when performing maintenance forecasts and cash-flow projections. These vital data points are needed to estimate the time being burnt off a given component, to determine when the component will reach its limiting interval before requiring maintenance, and to project the monthly reserve accruals.

Without the use of historical trend monitoring, these utilization assumptions would rely solely on the insight and experience of the Technical department. While this insight is certainly valuable, it can also be difficult to validate as it may not be derived from a defined source that can be cited. Using trend monitoring to determine baseline utilization assumptions provides defined and repeatable procedures that can more easily be cited for any maintenance and cash-flow projections.

Historical utilization ratio trends can also be instrumental in refining appropriate reserve rates (particularly for engines) and determining LLP contractual build standards (CBS). Since engine reserve rates can be influenced by utilization ratios, it is useful to have utilization trend data by operator and/or aircraft type. This can enable both the Technical and Marketing departments to better understand the appropriate baseline rates to offer on an engine when negotiating with a prospective lessee.

Historical utilization ratios for an operator and/or aircraft type can also assist in deriving an acceptable LLP CBS. Utilization ratios can be used to calculate how many cycles remaining LLPs must have to last a full mean time between repair (MTBR) run on an engine when receiving a performance restoration (PR). This is crucial in mitigating the risk of an operator short-building an engine during a PR, causing it to re-enter the shop earlier than expected due to an LLP being exhausted.

Historical trend monitoring can assist in determining baseline interval and event cost assumptions, which can then be applied to maintenance forecasts and in determining baseline reserve rates. As with utilization trend monitoring, the tracking and monitoring of maintenance reserve claims, in conjunction with OEM supplied data, can be used to establish baseline intervals and event costs that can be traced back to a source. Having strong source data to back up intervals and event costs greatly improves the accuracy of any maintenance forecast and cash-flow projection.

In addition, whether by operator or aircraft type, the quotient of historical event costs divided by historical intervals supports baseline reserve rate estimates. Robust historical trends can help to make these rates reasonable to the customer while limiting any exposure risk from being under-reserved.

The applications of historical trend monitoring extend well beyond what is contemplated here. With well-defined protocols and procedures for both capturing and extracting data, there can be boundless useful information and insight gleaned through trend monitoring. Other such

examples can include:

- Lag time between maintenance event dates and finalized claim reimbursement;
- Average shop visit downtime by component;
- Average transition costs by aircraft type;
- Tracking of operators that are continuously behind on payments;
- Average operating life of fleet before part-out;
- Changes to net book values (NBV) over time; and
- Spare engine pool trends and used (or sourced) LLP availability by engine type.

Maintenance Cash-Flow Forecasting

Maintenance cash-flow forecasting is one of the most nuanced uses of data, replete with innumerable considerations and caveats. Robust forecasting tools and procedures are also increasingly relied upon for financial reporting and obtaining a competitive edge.

A comprehensive and accurate maintenance forecast can empower a more strategic approach to portfolio management, provide an upper hand in contract negotiations, better determine maintenance liabilities, and ultimately result in higher revenue by optimizing end of life aircraft to avoid costly and unnecessary maintenance events. Yet, what goes into a forecast is often considered a black hole of data points and variables, making it a particularly difficult task to accomplish with a high degree of accuracy.

Setting aside the complex calculations and logic trees that comprise a maintenance forecast—a subject onto its own—understanding and extracting the requisite data points is the foundational step in producing a forecast. The baseline data inputs required in forecasting are often derived from multiple sources, spanning across several departments. These sources encompass:

- Current technical specifications and maintenance status including LLPs;
- Baseline assumptions or a knowledge base (e.g., event costs and intervals including LLPs, average utilization);
- **Contractual terms such as**:
- Lease terms;
- Reserve rates;
- Return conditions (RC);
- Rate escalations;
- Top-Up obligations;
- EOL compensation or Top-Up mechanisms;
- Unique lease provisions (e.g., reserve caps);
- Current reserve balances (as aligned to current technical status).

This can amount to well over 1,000 data points, coming from different locations that need to be extracted and parsed for relevancy. If a forecasting tool is not integrated with your company's databases, then those responsible for running forecasts likely need to manually retrieve these data points from their respective sources. This becomes another time-consuming and redundant data entry task that must be done before even getting to the primary purpose of running a forecast. Furthermore, with the quantity of requisite inputs, manual data entry in forecasting creates a high risk of human error.

Even seemingly small discrepancies or issues with the requisite data inputs can result in large inaccuracies in a forecast. For example, if the return conditions were entered incorrectly, then a forecast may miss an engine shop visit that is expected to occur. On a narrowbody, this could mean that a forecast is off by over $3 million. On a widebody that number can be closer to $10 million.

Forecasting tools or modules that are integrated with your company's databases (or asset management system) can reduce the need for redundant and risky manual data entry. By being integrated, the requisite data can be mapped directly from its respective source to the forecasting module—a substantially more efficient process. However, mapping the data comes with its own risks—especially if the underlying database for an asset management system is inconsistent in tying together the various sources. Poorly constructed relational databases can result in pertinent information being missed when being mapped to the forecasting module.

If the underlying relational database contains incongruities with its identification of a given component across the multiple sources, then important data related to that component will not be successfully mapped to the forecasting module.

So if an engine component in a technical status module is not correctly tied to the same engine where the current reserve balances are recorded, then the engine may map to the forecasting module with no opening reserve balance assigned to it.

A forecast's accuracy is also predicated on how current the technical status data is. If the most recent maintenance events on an aircraft were not successfully captured, then any forecast on the aircraft is inherently skewed. The missed events would likely become forecasted events occurring at a later date than in reality. This causes a trickle-down effect, skewing the rest of the forecast.

Outdated or stale technical data can also increase the burden of a forecast. If the most recent spec data is over a year old, then, despite being a historical timeframe, that year must be forecasted as well. Adding years to a forecast, especially historical ones, increases the likelihood of inaccuracies that can then permeate through the rest of the forecast.

> *"Keeping up to date on utilization report entry is the best protection against having outdated information. The data entry tools previously noted can also go a long way in staying ahead of the game on any maintenance activity, thereby strengthening the baseline position of a forecast."*

The complexity of forecasting and the wide array of requisite variables puts a premium on having an integrated system with well-defined and constructed relational databases that contain the latest and most accurate data available. Such a system, combined with historical trend monitoring, allows those responsible for running forecasts to spend less time on data entry and validation of each baseline data point. Instead, forecasters can be more

confident in the results of their forecast without requiring extensive manual manipulation to the inputs. This allows for quicker turnaround, especially when running fleetwide forecasts that are used for budget projections.

In addition, with less time spent entering and validating the baseline data, a forecaster can devote more time to "what if" scenarios. Knowing that the baseline data is sound, the relevant stakeholders can explore and determine the best solutions during lease negotiations and/or end of life planning. This could be identifying ideal term lengths to avoid costly maintenance events, determining the impact from rate changes or from switching a reserve payer to an EOL payer, and/or understanding the impact of waiving return conditions. Confidence in the baseline data means confidence in the results of those "what if" scenarios, which can give your company a competitive edge.

It should also be noted that there is an increasing expectation to track and monitor engines down to the modular level, which can significantly refine projected maintenance liabilities. Meeting this rising expectation, could lead to an influx of data requirements for lessors to accommodate, especially as it relates to maintenance cash-flow forecasting.

Capturing engine spec data down to the modular level may require a complete overhaul of a lessor's current approach to recording engine data—meaning engines will require a whole new series of data points that must be recorded with the ability to map to any forecasting module. This can entail a large-scale data entry project to input the modular level data. It may also require changes to the underlying relational database to accommodate this new data, while still associating it to the engine as a whole.

Current Asset Valuations

Current, up-to-date asset valuations are needed to understand the monetary value of a company's fleet and its maintenance liability. This is essential for an upcoming acquisition, large portfolio sale, change in accounting policies, and/or upcoming audits. Understanding the current asset value requires knowing the last major maintenance events and current spec status. Valuations are also predicated on event cost and interval assumptions. These, in conjunction with the spec status, are used to derive the monetary value consumed and remaining, as well as the green-time (time left before maintenance is needed) for each component.

As with maintenance forecasting, this requires having accurate and up-to-date technical specifications as well as having a strong rationale behind any event cost and interval assumptions. These can be bolstered by providing evidence from historical trend monitoring. Fleetwide valuations can be a massive undertaking, but having thorough and defined data management procedures can greatly improve the efficiency of its production and the efficacy of its results.

Handling the Challenges and Opportunities of Data Requirements

Throughout each stage of the data life cycle there are many challenges to overcome. Each of these challenges, however, comes with the opportunity to refine your business practices to match the efficiency needed with the efficacy desired.

From start to finish, Zeevo Group is prepared to assist you in facing these challenges. Along the way, we can help you uncover new, innovative ways to make your data one of the most reliable tools in your company's arsenal.

At the turn of the century, in a chapter titled "A Law of Acceleration," Henry Adams contemplates the consequences of a rapidly accelerating world. In essence, he posits that with each question answered, two new ones are raised. Enhancing our use of data today and the eventual implementation of "big data" will certainly answer many questions. But, which new ones will arise? This remains beyond a horizon that we are ceaselessly accelerating towards. Are you ready? Is your company ready?

IN BRIEF:

- **Inaccurate data is costly:** Missing or false data can result in millions of lost revenue and higher expenses.
- **Define procedures:** Well-defined (and documented) procedures improve the efficiency of capturing data and mitigates the risk of erroneous or missing information.
- **New technologies are changing the game:** Whether though records management functionality, web portals, automated checks, business intelligence products, or "big data" capabilities, modern technologies exist to capture and unleash the power of vast quantities of data.
- **Advanced analytics give companies a competitive edge:** Leveraging robust and quality data to create historical trends, produce accurate maintenance forecasts, and establish asset valuations can give a company a leg up in a competitive market.

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