



Test Enterprise Knowledge Management - A Case Study In Data Governance

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The F-35 Test Enterprise





Setting the Stage

- **Geographically-separated test venues, each with their own advantages**
- **Geographically-separated pockets of subject matter expertise**
- **Hundreds of terabytes of data generated on a weekly basis across the enterprise**
- **Data collected to meet test or verification objectives, in a manner that is tailored to local best practices**



The Problem

- **Volume** of flight test data collected is greater than ever
- **Velocity** at which flight test data is collected is greater than ever
- **Variety** of flight test data collected is greater than ever
- The number of geographically-separated stakeholders to extract **value** from the data is, by necessity, greater than ever

How can the enterprise ensure it is extracting the maximum value out of the data it generates?



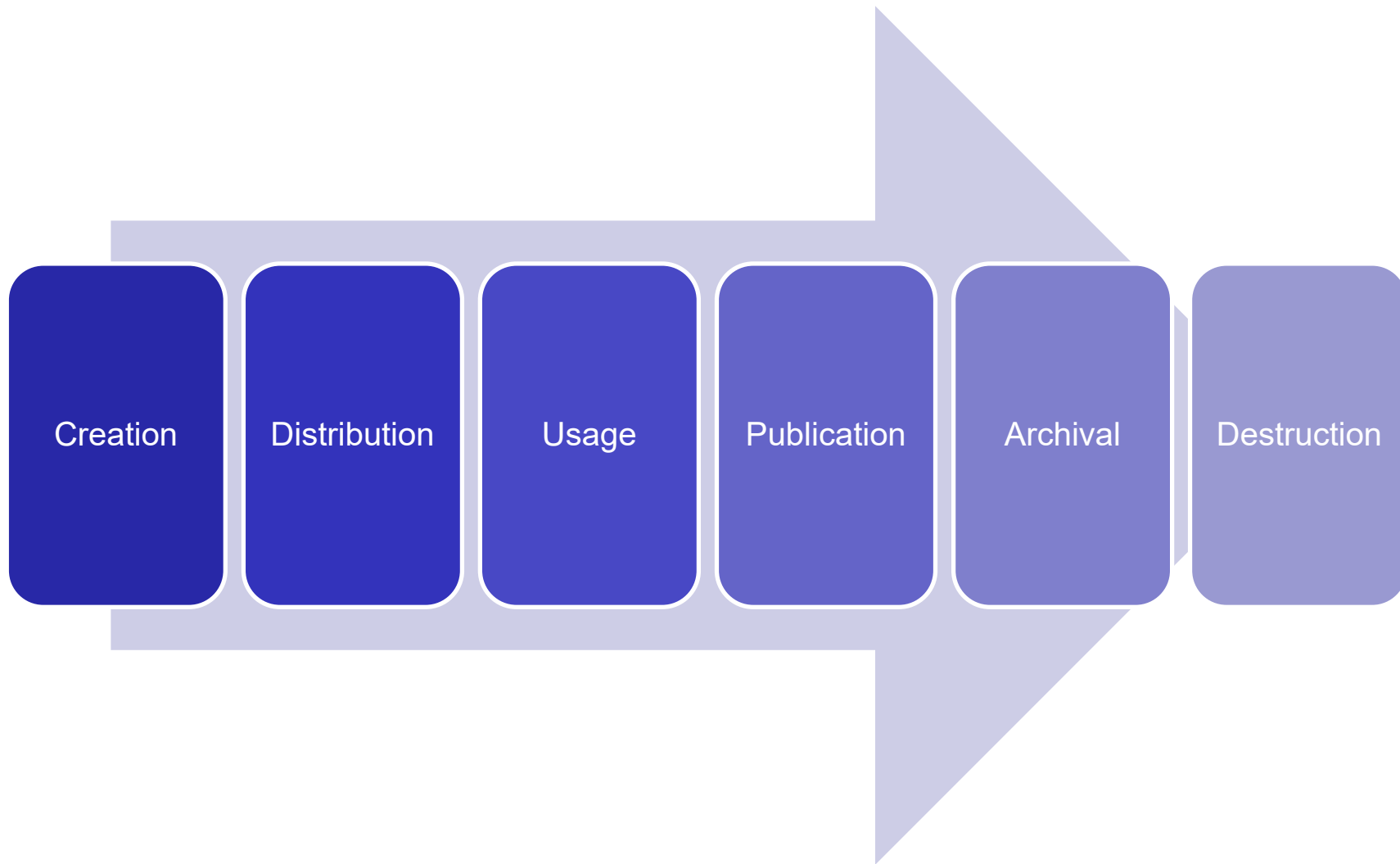
What is Data Governance?



- **Process guided by set of internal data standards and policies that define the management of...**
 - Data availability
 - Data usability
 - Data integrity
 - Data security
- **Alternatively, we can think of data governance as the set of principles by which an organization manages its data's life cycle**
- **By proxy, dictates decisions made on infrastructure**



Phases in the Data Life Cycle

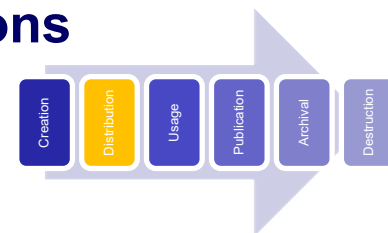




Case Study: F-35 Flight Test Data Distribution



- **Key challenges tied to data sharing infrastructure fragmentation prevent effective distribution of information across the enterprise**
 - **F-35 DT and OT on separate networks**
 - **The aircraft developer and F-35 DT are on the same network**
 - **Each OT squadron on its own network: 3 separate networks!**
 - **Historically, the Program Management Offices are responsible for establishing data networks that support their program while being reliant on separate transport networks**
 - **Without a centrally managed data sharing infrastructure that works for the entire enterprise, stakeholders venture off on their own or enter into agreements to align solutions**

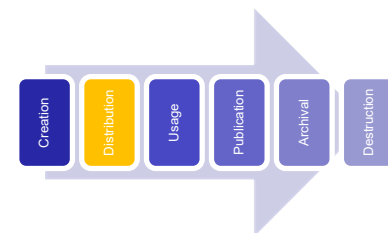




Case Study: F-35 Flight Test Data Distribution



- **A key component of data distribution is accessibility!**
- **Fragmentation across multiple networks and geographical locations means that data is less accessible, which negatively impacts usage and publication**
- **Without accessibility, big data analytics, machine learning, or artificial intelligence are a pipe dream**





What is Big Data?

- In 2001, Doug Laney defined big data by the three V's:
 - Volume: how much data is being produced
 - Velocity: the rate at which data is being produced
 - Variety: the different types of data (whether structured or unstructured)
 - Since then, the definition of “big data” has greatly been expanded upon in academia, but let's add our own term: Value, as a measure of the quality of the inferences we can draw from the data



Case Study: F-35 OT Big Data



- In the course of operational test and evaluation of the latest software release, the F-35 OT enterprise generated over 1600 flight hours
- Roughly two thirds (~1100 flight hours) were generated on instrumented aircraft
- The test enterprise thoroughly analyzed roughly about a quarter of those flight hours (~280 flight hours)
- What about the other ~840 flight hours? Surely not all of them are void of value...



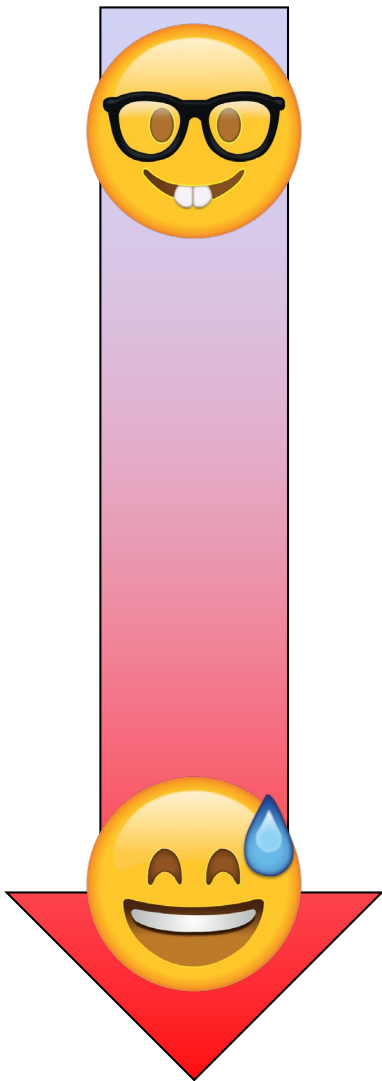
Flight Test Data Analysis



- **In flight test, context is everything: conditions, parameters, constraints, limitations**
- **However, many issues or deficiencies are uncovered while the aircraft is in transit, or between test points**
- **Perhaps it is time to develop a methodology of extracting value from all flight test data to augment the inferences drawn from the data collected while “on conditions” ...**
- **And the infrastructure that supports it!**



F-35 Examples



Sensor Availability and Stability: How often does a sensor fail? Can patterns or trends be identified?

Multi-Ship Mission Effectiveness: Is the effectiveness of a multi-ship task or capability correlated to formation geometry? Target of interest? Can new best practices be identified?

Truth Completeness: How complete and truthful is the air and ground picture displayed to the pilot?



Conclusion

- **The flight test enterprise is ready to begin harnessing big data analytics, machine learning and artificial intelligence to accelerate, refine, and improve the development of modern-day aircraft**
- **However, none of these things are possible without thorough data governance implementation and the infrastructure to support it**
- **While PMOs typically stand up their own networks, the Test Centers and test ranges may consider creating infrastructure that enable and standardize data governance for the programs they support**