Contingency Workload Demand Forecast Techniques for Cargo and Flying hours

Research Objective
- Investigate various workload demand forecasting methods to ascertain if such methods can help CDRTRANSCOM better forecast resources to contingency workload demand and enhance maximization of readiness.

Survey of literature revealed very little research on accurate predictive contingency workload behavior.

Time Series responses are:
- Cargo (short tons (st)) and Flying time primarily from AMC platforms (e.g. C5, C17, C130, KC10 and KC135)
  - 1,313,246 st
  - Cargo has spike in Oct 2014
  - Overall, possible downward trend
- 1,021,456 fl. hrs
- Seasonal flow
- Mar/Oct: (spike)
- Nov-Feb: low
- Apr-Aug: flat
- Evidence of downward trend

Forecast Methodology
- STEP 1: Choose a response time series
  - a. Filter data to applicable missions
  - b. Filter data to applicable aircraft
- OPTIONAL: add a regional variable
- STEP 2: Execute VBA 'Convert date' macro
- STEP 3: Use Excel's Pivot table to aggregate time series
- STEP 4: Enter time series into forecast software package
- STEP 5: Plot time series response
  - a. Examine residuals for homoscedasticity
  - b. Start with smoothing forecast models, then Box-Jenkins (BJ) (if BJ, go to option 5c)
  - c. Test for stationarity
  - d. Review/Assess/Compare forecast model results.
  - e. OPTIONAL: if dissatisfied with the aforementioned techniques, consider, separating time series into regional time series and Review/Assess/Compare to other forecast results
- STEP 6: Apply median-based forecast
  - a. Review/Assess/Compare results to other forecasts. If APE is ≤ 20% and less than other forecast models, select median forecast model

Introduction
- “My top priority continues to be preserving readiness and focusing our efforts and limited resources to contribute to the Command’s ability to support national security priorities.”
- 2015 CDRUSTRANSCOM

Problem Statement
- USTC lacks the ability to accurately forecast contingency workload, which is a key driver for service provider rate-setting.
- Improved workload predictive capability enables improved management of USTC budget.

Takeaways
- Is there a methodology that can provide an improved forecast for USTC planners? (good possibility)
- Apply to other USTC components (e.g. SDCC, MSC)
- Track/Compare performance
- Can past demand data be decomposed to allow that demand to be attributed to past contingencies? (uncertain, needs more exploration)
- Statistical tests to examine time series behavior are highly sensitive; easily swayed to ‘fail’ normality assumption
- Many times, the easier more practicable solution (i.e. median-based forecast) is the best way-ahead as opposed to fancier models that lend to overfit

Future Research
- Consider neural networks (be mindful of the overfit)
- Re-examine regional analysis; delineate by AOR or COCOM and study forecasts for improvement
- Help USTC find ways to collect more leading indicators (e.g. price of fuel, weather patterns, policy changes, requirements shifts, etc.)

Statistical Summary:
- Cargo
  - 1,313,246 st
  - Cargo has spike in Oct 2014
  - Overall, possible downward trend
- Flying hours
  - 1,021,456 fl. hrs
  - Seasonal flow
  - Mar/Oct: (spike)
  - Nov-Feb: low
  - Apr-Aug: flat
  - Evidence of downward trend

Forecast Accuracy:
- Model/year
- APE
- Median
- MAPE
- ARIMA
- SMA
- MA
- Exponential Smoothing

Sponsor:
Agency: USTRANSCOM
Contact: JDPAC