With any model-based analysis, outputs are only as good as the inputs. We collected extensive data from multiple Air Force sources and checked the nominal values used to minimize errors. Prior to designing the analysis model, the LANTIRN working group team verified many of the critical values used. This team, led by RAND, included representatives from Air Combat Command, Warner Robins SPO, Air Force Logistics Management Agency, and HQ USAF.

We realized, however, that no amount of data could fully compensate for the significant uncertainties in future deployment and employment scenarios. We therefore built models to assess input variable uncertainties and augmented our earlier sources with data collected during the AWOS.

Our treatment of pod removal rates from aircraft demonstrates how we accounted for uncertainties. Aircraft pod removal rates are the primary influence in determining aggregate repair asset requirements. We were able to collect reasonably accurate peacetime removal rate data and to extrapolate values to wartime programs. The data, however, are historical and may not accurately predict pod performance 10 years from now. Although we have not seen increased failure rates in the last eight years of operation, we also have no indication that this “flat” trend will continue. More important, data collected in the AWOS indicate significantly higher wartime removal rates than predicted using current algorithms.

Figure F.1 shows the removal rates for F-16s flying from Aviano during the AWOS as a function of average sortie(s) duration. Our conservative estimates predict wartime removal rates close to those
observed in peace operations (average sortie duration = 1–2 hours). However, the wartime rates are much higher. We modeled this effect through the simulation approach described earlier and included the recomputed removal rates for F-15Es, which varied by well over 150 percent, as shown in Figure F.2.

Simulating the removal rate as well as repair time distributions and expected support equipment processing time improvements generates a 90-percent confidence interval for the expected number of test sets (discussed in the body of the report). In Figure F.3, we show the sensitivity of this output to the expected support equipment performance range described in Appendix B. Note that at the 90th-percentile level there is some effect on tester requirements as a function of expected availability. Yet, as the chart on the right of Figure F.3 indicates, test set resource requirements are very sensitive to expected repair times, implying that future upgrades to the support equipment must be closely monitored to ensure that expected performance levels are achieved.
Note: Lakenheath F-15E targeting pod removals (n = 82 removals, s = 1666 sorties in Operation Noble Anvil)

Figure F.2—F-15E Targeting Pod Removal Rates During the AWOS

Figure F.3—Sensitivity of Support Equipment Requirement to Availability and Other Uncertain Input Variables
However, one cannot lose sight of the tremendous uncertainty associated with wartime removal rates. As Figure F.4 indicates, a 10 percent removal rate change may drive an average requirement increase of one test set and eight people for a regional structure. And, as discussed earlier, AWOS data indicate that wartime removal rates may be over 150 percent higher than currently predicted.

Personnel requirements exhibit similar patterns relative to removal rates, yet with a stronger sensitivity to expected removal rates and repair time. Figure F.5 shows the relative sensitivity of the number of personnel required versus six uncertainties modeled. We simulated a random set of inputs pulled from distributions based on data collected before and during the AWOS. Again, wartime removal rates are the primary new data assessed from the AWOS. The chart on the right of the figure shows the repair time distribution used to model targeting pods.

We next review our comparative analysis of the range of options assessed. We show resource level requirements based on data col-
lected during the AWOS. We also depict results based on an assumption of 80 percent availability for single strings regardless of investment level. Earlier we showed that expected availability does not significantly affect our outcomes. Because we address relative value differences, the strategic decision outcomes discussed in the body of the report do not change.

Figure F.6 summarizes the 90th-percentile test set requirement for peace and wartime (halt-phase) scenarios, three logistics structures, and the upgrade option combination. Because the stressing and halt scenarios yield identical resource requirements, we do not show the stressing case results. The white bars represent peacetime needs, and the black bars depict the halt scenario requirements for a two-MTW scenario. We show logistics structures on the horizontal axis, including decentralized support, one CONUS with two OCONUS support locations (three regionals), and a single CONUS location as the lower bound.

The first group of bars on the far left shows the requirement with no support equipment (SE) investment. Note that regardless of centralization level, there are not enough test sets to support two coincident
MTWs. Although the CONUS-only options offer some opportunities, we showed in the body of the report that transportation capacity limitations prohibit the Air Force from considering this structure as viable. The set of bars on the right show similar requirements for upgraded equipment (we assumed identical availability levels, as discussed earlier). Again, there are too few sets to accommodate coincident wars. Note that a three-regional option may require more support equipment than a decentralized structure. This finding is primarily driven by potentially slightly oversizing these facilities as a result of our computations at the 90-percent confidence level, resulting in low utilization of the CONUS-based equipment during war and a negation of the collocation effect. Specifically, this option represents a breakpoint in our models where collocation does not reduce resource requirements at the confidence levels we targeted. However, as we move to full consolidation in the CONUS-only option, collocation does reduce the number of required resources.
Therefore, it appears that the Air Force must invest in upgrades to the current system, regardless of whether it continues to use the current decentralized structure or a consolidated structure, if it is to meet the requirements for a two-MTW halt scenario.

From the base of an ADK investment, we calculated two further options, first for the four-echelon structure with ADK for pod removal and replacement and second for the MLU + ADK investment (both not charted). The four-echelon structure, with the ADK investment for pod removal and replacement, requires more ADKs than the decentralized system (with ADKs) because each base would require at least one ADK and then the centralized repair site would require additional test sets. The next level of investment is for the MLU, which includes the ADK plus additional capabilities and performance enhancements. We did not model this option explicitly because we could not predict availability relative to this incremental investment. Figure F.7 displays personnel requirements for the same scenarios,
investment, and consolidation options described for the previous graph on tester requirements.

The lower requirement we calculated for wartime is most likely attributable to the manning allocation methodology used in our model. Whereas the Air Force uses a standard back-shop sizing approach to assign LANTIRN support personnel to aircraft, our model employs the industrial engineering concepts described earlier as well as two distinct productivity levels. We also computed the bare minimum manning requirement to support wartime operations (excluding trainees). Conversely, in peacetime we included trainees in the total requirement.

Unlike equipment needs, manning requirements decrease with consolidation. Regional personnel needs were calculated to accommodate AEF rotations into USAFE and PACAF, so the peacetime manning in those regions could be higher than the local peacetime demand dictates. An alternative approach is to keep minimum personnel levels at OCONUS sites and then deploy people to the FSLs in support of AEFs. We show this option in the body of the report. Based on our analysis, there appear to be sufficient people in the Air Force today to fill all contingency requirements. However, certain assumptions about trainees and skill levels may change the total resources needed.