RT-140: Advanced Technical Leadership

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1 Executive Summary

This report summarizes the research findings, conclusions, and recommendations for SERC Research Task 140. The task was intended to facilitate the transition the curriculum content and structure of SYS 350B Business Lens and SYS 350C Enterprise Lens to the Defense Acquisition University (DAU) for their use in training Department of Defense (DoD) systems engineers (SE) and technical leaders for key leadership positions at senior and executive levels. The curriculum for the two courses had previously been developed, tested and refined under SERC Research Task 4 (RT 4), and was validated during student pilots conducted at DAU in December 2013 and March 2014, respectively.

The original intent of RT-140 was to integrate the SYS 350 B&C material into the initial pilot of a larger 11-month Key Leadership Development Program (KLDP) being developed by the Defense Acquisition University (DAU), with sponsorship of the Missile Defense Agency (MDA) in Huntsville, AL. The SYS 350 B&C courses were respectively designated as Segment 3 and Week 1 of Segment 5 of that 7-segment program.

Following completion of the Segment 3 workshop in November 2015, however, it became apparent to both the SERC and the DAU teams that simply integrating the SYS 350 material into KLDP would not meet the needs of the KLDP learners or of their sponsors. It was concluded that a significant redesign would be required, not only of the SYS 350 material, but also of the entire final 14 weeks of the KLDP Program that Segment 5 was to usher in. Activity to accomplish the redesign was initiated in January 2016, and RT-140 was formally amended on March 5, 2016 to reflect the increased integration scope and provide additional funding to support the effort.

The redesign was undertaken in a spirit of collaborative learning between the SERC and DAU. This “one team” approach eliminated surprises, gaps between program elements and unwarranted assumptions, and capitalized on the unique strengths of people from different organizations. It culminated in a highly successful Segment 5, delivered at DAU in March 2016. Following Segment 5, eighty-two percent of the learners reported that the KLDP program had accelerated their transition to executive leadership by at least a year and fifty percent said it had done so by two years or more. And eighty-six percent said the SERC instructors should be brought back for Pilot 2, either to teach themselves or as consultants to DAU instructors. As of the time of this report, DAU is working toward completion of KLDP Pilot 1 in June and leveraging what was learned from Pilot 1 into the design of Pilot 2, which will be launched in July 2016.

2 Background

The overall approach and course material for SYS 350 B&C that was to have been transitioned to the DoD under RT-140 was developed and validated under RT-4.\(^1\) The research hypothesis for RT-4 had been:

“The technical leadership capabilities of high potential, senior DoD systems engineers and technologists can be accelerated through an educational program in technical leadership.”

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That hypothesis was validated for the first of three courses, SYS 350A The Systems Lens, during FY 12, and for the second and third, SYS 350B Business Lens and Sys 350C Enterprise Lens, during FY 14.

Given the successful conclusion of RT-4, the research hypothesis for RT-140 was:

“The SYS 350 B&C material developed and validated during RT4 Y4 can be leveraged as a key component of the larger Key Leadership Development Program (KLDP) being developed by DAU, with sponsorship from the Missile Defense Agency (MDA).”

That hypothesis was validated under the present task, although not without significant redesign of the material and approach to better match the needs of the KLDP learners, incorporate guidance from the KLDP Executive Steering Committee, and better integrate the material with other components of the KLDP program. In the process, the research hypothesis of RT-4 was also further validated.

2.1 RT4 YEARS 1/2/3 OVERVIEW, FINDINGS, & CONCLUSIONS RELATED TO SYS 350 B&C

RT-4 Year 1: In FY09, DAU contracted with the Systems Engineering Research Center (SERC) to evaluate the hypothesis that the technical leadership capabilities of high potential, senior DoD systems engineers and technologists could be accelerated through an educational program in technical leadership. The research task, designated as RT-4 (Systems Engineering Technical Leadership) included research of state-of-the-art and best practices associated with technical leadership education and then, along with the industrial, academic, and government leadership experience of SERC collaborators, development of a technical leadership program as a capstone element to DAU engineering courses. The hypothesis would then be evaluated through a series of pilot courses attended by Defense Acquisition University (DAU) faculty and DoD systems engineering professionals.

The RT-4 research team collected data from government, industry, and academia and developed technical leadership curriculum architecture to frame the ensuing pilot course research and development. The architecture views technical leadership through three apertures or lenses that represent the expanding responsibilities of an engineering leader, from developing systems as a project technical lead (Systems Lens), to the programmatic challenges of an IPT lead (Business Lens), to the responsibilities of a technical executive (Enterprise Lens). These three nested lenses framed the subsequent curriculum research. The RT-4 SE technical leadership course architecture was designated as SYS 350 by the DAU, who further established that the SYS 350 course would comprise a series of three 5-day modules designated as SYS 350A (Systems Lens), SYS 350B (Business Lens), and SYS 350C (Enterprise Lens).

Using the SYS 350 architecture, learning objectives, desired outcomes, and focus areas were identified for each of the three modules and the focus areas were populated with a draft list of topics. Available courseware was compared to the topical outline for each lens to identify areas where materials existed that could be tailored to support the DAU TLP model.

RT-4 Year 2: While the second year of the task was primarily focused on developing SYS 350A Systems Lens, the SERC team also completed preparatory work to lay the foundation for the SYS 350B Business and SYS 350C Enterprise Lenses to be developed in Year 3. Additional research delivered a set of working definitions for technical leadership and a framework for discussing how leadership actions in a
technical environment might differ from and also align with successful leadership practices from other disciplines. These research findings were presented to the DAU, refined, and leveraged to provide additional bases for the ensuing SYS 350 development work.

The SERC team continued a review of Year 1 SYS 350 architecture, validated that the three-lens approach remained an appropriate framework for development, and refined the architecture to include updated focus areas for each lens. Using the evolved SYS 350 architecture, the team then developed a series of course descriptions to outline the goals, objectives, and key activities of each of the lenses

At the conclusion of RT-4 Year 2, the SERC provided an initial approach, architecture, and materials for SYS350B to DAU on 12 December 2011.

**RT-4 Year 3:** While an additional SYS 350A pilot was conducted during Year 3, the SERC team shifted its primary focus to SYS 350B&C, a) repeating the SYS 350A process to develop SYS 350B and C courses, b) conducting two SYS 350B Business Lens pilots, c) conducting two SYS 350C pilots. These objectives were accomplished and at the end of year 3, SYS 350A was recommended for transition to the DAU portfolio of systems engineering courses with minor changes. SYS 350B and 350C, however, were not recommended for transition. While the research demonstrated that many of the elements needed for the Business and Enterprise Lenses were in hand, it also revealed four significant shortcomings of SYS 350 B&C. Specifically, they:

1) Lacked the overall coherence of SYS 350A,
2) Contained more topics than could be effectively covered in the available time,
3) Were overly focused on the commercial domain, and therefore,
4) Required additional tailoring to apply the covered leadership principles to the domain of defense procurement.

DAU concurred with the RT-4 Year 3 recommendations and funded RT-4 Year 4 to refine both SYS 350B and SYS 350C curricula and conduct additional pilot testing.

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**2.2 RT4 Year 4 Overview, Findings, & Conclusions**

**RT-4 Year 4:** The objectives of the RT4 Year 4 research were to a) address the observed shortcomings of the RT4 Year 3 SYS 350B and SYS 350C pilots by leveraging lessons learned during the SYS 350A pilot phase, b) refine and enhance the integration of the SYS 350 B&C syllabi, and c) conduct SYS 350 B&C student pilots to validate the iterated syllabi. These objectives were fully met. Shortcomings of the SYS 350B and SYS 350C pilots were successfully addressed by leveraging lessons learned from SYS 350A, particularly the power of an embedded group project to impart a consistent story arc throughout the courses; the SYS 350 B&C syllabi were refined and better integrated; and student pilots that validated the revised courses were conducted for SYS 350B in December 2013 and SYS 350C in March 14, 2014. The final recommendation at the conclusion of RT4 Year 4 was that DAU leverage the material and approaches from SYS 350 B&C to develop an educational program that would help fill the void in advanced leadership education/training for current and future technical leaders within the defense acquisition community.
3 SYS 350 B&C Transition

3.1 Transition Approach

The research hypotheses for RT-140 was:

“The SYS 350 B&C material developed and validated during RT4 Y4 can be leveraged as a key component of the larger Key Leadership Development Program (KLDP) being developed by DAU, with sponsorship from the Missile Defense Agency (MDA).”

The objective of the research was to refine the SYS 350 B&C material by incorporating lessons learned from the student pilots conducted during RT-4 Year 4, and then integrate it into the 11-month KLDP curriculum as two of the planned seven segments of the program.

The overall objectives for KLDP were to:

- Improve Critical Thinking for Acquisition Workforce key leaders
- Improve Functional Proficiency of Key Leaders to assist in managing Complex Programs
- Hone Leadership and Teamwork skills of Key Leaders to Facilitate Change
- Establish Competency-Based Confidence to Exercise Decisive Judgment

An overview of the program is provided in Figure 3.1

**FY15 MDA KLDP Pilot Overview**

**Figure 3.1: KLDP Program Plan**
As indicated in the figure, SYS 350B Business Lens was to be Segment 3 of the program and SYS 350C Enterprise Lens to be the first week of the two-week Segment 5.

DAU designated the FY 15 KLDP as Pilot 1 of a planned multi-year development. Pilot 1 included 24 “learners,” 16 from the MDA, 2 each from the Army, the Navy and the Air Force, and two industry representatives from Raytheon Missile Systems in Tucson, AZ.

### 3.2 SYS 350B TRANSITION – KLDP SEGMENT 3

KLDP Segment 3 was a six-day workshop conducted on-site at Raytheon Missile Systems (RMS) in Tucson, AZ from November 16-21, 2015. In keeping with its designation as the Business Lens, the workshop included guest presentations by senior Raytheon executives and a half-day factory tour of the RMS facilities. The remainder of the week incorporated content drawn from SYS 350B, specifically business modules that addressed finance, strategy and innovation, and leadership development modules focused on individual value propositions, leadership behaviors and emotional intelligence. The detailed program and schedule for Segment 3 is shown in Figure 3.2.

![Figure 3.2: KLDP Segment 3 Program and Schedule](image-url)
As indicated in the figure, the SYS 350B content was interleaved with the Raytheon presentations to maximize the synergy between classroom content and related exercises and the real-world perspectives of Raytheon business leaders. The desired synergy was observed many times during the program.

The workshop appeared to go well during the week, as judged by the SERC instructors and members of the DAU faculty in attendance. There were comments made by the learners throughout the week, however, that indicated that much of the content was not what had been expected. In particular, they anticipated much more interaction with Raytheon employees, and learning opportunities that were more focused on operations and culture at the program level, rather than at the corporate and strategic level. They were also surprised by the amount of leadership development content included during the week. The DAU KLDP Program Manager acknowledged that although the learners were fully aware of the syllabus, he had not done an adequate job communicating the strategic view of the lesson content to the learners prior to the event.

Post-course feedback from the learners was not as favorable as the initial impressions of the faculty, and in fact was a surprise to both the SERC instructors and the DAU faculty members. When asked to rate the overall value of Segment 3 toward meeting their learning objectives during the KLDP, learner responses varied widely. While 17% of the respondents rated the overall value as 8 or higher on a 10-point Likert scale, the median score was 7, and 28% of the respondents rated it 6 or below. The results are displayed graphically in Figure 3.3.

![Figure 3.3: Segment 3 Feedback on Overall Quality](image)

While these results were certainly not bad – three-quarters of the respondents rated the program more favorable than not – they did represent a marked contrast with the feedback from the SYS 350B student
pilot conducted in RT-4 Year 4. In that earlier pilot, every one of the participants rated the course “personally beneficial,” and 80% rated it “very beneficial.” (These were the top-two categories in the 5-point Likert scale used to assess the SYS 350B pilot.) Clearly, the Segment 3 results required further investigation.

3.3 KLDP Segment 3 Assessment and Conclusions

The SERC instructors and members of the DAU faculty analyzed the feedback from KLDP Segment 3 in a series of conference calls during December 2015. Those discussions were supplemented with conversations between members of the DAU faculty, the MDA sponsor and selected KLDP learners. Verbatim comments from the learners were highly complimentary of the Raytheon portions of the program but considerably less so of the portions provided by the SERC. Many learners felt that the leadership development modules were a distraction from the business focus of the segment. Several did not see the synergy between the business modules and the presentations of the Raytheon executives that had been so obvious to the instructors during the workshop. The SERC/DAU assessment produced four principal conclusions:

1. As suggested by their comments during the workshop, the learners’ expectations for Segment 3 had not been properly set by DAU. They were expecting a program dominated by interactions with Raytheon executives, when such interactions were only one of three planned components. The program also included business modules and leadership development modules derived from SYS 350B and delivered by SERC instructors from Stevens. The resulting gap between the learners’ expectations and the program was a major source of disappointment for many of the learners throughout the week.

2. The average experience level of the KLDP learners was less than that of the participants in SYS 350 B&C. This reduced the effectiveness of the material and approaches that had worked previously because the learners were asked to step into situations and roles for which they lacked adequate scaffolding to support them in doing so.

3. A SERC instructor had conducted private phone conversations with all learners and most Faculty Advisors prior to the classroom session to discuss each person’s emotional intelligence inventory report. The expectation was that learners would come to the classroom prepared to dive deep into these foundation leadership skills. This preparation did not occur with all students, limiting the effectiveness of the discussions in the classroom.

4. Segment 3 days were too long and too packed with material. Even lunchtime was given over to the Raytheon executive presentations. Little personal and reflection time was built into the day. This inhibited the learning process.

Clearly, KLDP Segment 3 had been set up for a less than desirable outcome. In addition, further investigation led the SERC instructors and the DAU faculty to an even more important fourth conclusion:

5. The basic structure of the KLDP Program as originally designed was more heavily focused on cross-functional management than executive leadership. Beginning with the cases included in Segment 1, through the capstone project, to the “Shark Tank” in Segment 7, the emphasis had
been placed on solving tactical problems rather than on developing and leading strategic change.

Conclusion 5 not only limited the success of Segment 3, it jeopardized the overall objectives of KLDP. Changes would be obviously required before Segment 5.

### 3.4 Redesign of KLDP Segments 5-7

Based on the findings and conclusions from Segment 3, the SERC team and the DAU faculty began working together immediately after the first of the year to redesign not only KLDP Segment 5, but also Segments 6 and 7 to follow. The redesign was undertaken as an exercise in collaborative learning between the SERC and DAU. This “one team” approach eliminated surprises, gaps between program elements and unmet assumptions, and capitalized on the unique strengths of people from different organizations. It proved far more powerful than the “divide up chunks” approach that had been used to that point. In the process, the entire design community learned how to work more effectively under conditions of uncertainty, ambiguity and conflicting needs. The disappointments of Segment 3, in effect, became a catalyst for a breakthrough in the design approach that produced excellent outcomes in record time.

The goal of the redesign was to approach the final 14 weeks of the program as an integrated whole and to shift the primary focus from cross-functional management to executive leadership. Figure 3.4 indicates how the intended transition was represented.

![Graph showing the transition from senior management to executive leadership in KLDP Segments 5-7.](image)

**Figure 3.4: Shifting the Emphasis in Segments 5-7**

The relative heights of the elements in the figure indicate the degree of emphasis to be placed on each. While more time had been spent on senior management during the first four segments, greater emphasis would be placed on executive leadership during the final three, to ensure that both elements received adequate treatment by the end of the program.

It was important that the transition from senior management to executive leadership not be seen as invalidating anything that had been done during Segments 1-4. Rather Segments 5-7 were designed to provide a complementary focus, as illustrated in Table 3.5.
<table>
<thead>
<tr>
<th>Not Only...</th>
<th>...But Also</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical</td>
<td>Systematic</td>
</tr>
<tr>
<td>Linear</td>
<td>Nonlinear</td>
</tr>
<tr>
<td>Deterministic</td>
<td>Uncertain</td>
</tr>
<tr>
<td>“Tree-cutting”</td>
<td>“Axe sharpening”</td>
</tr>
<tr>
<td>Solving problems</td>
<td>Asking meta-questions</td>
</tr>
<tr>
<td>Evaluating</td>
<td>Sense making</td>
</tr>
</tbody>
</table>

**Table 3.5: Transition from Senior Management to Executive Leadership**

In addition, to emphasize the need for leaders to continually learn, a two-plane metaphor was introduced, as illustrated in Figure 3.6.

![Diagram](Plane of Observation and Plane of Action)

**Figure 3.6: Introducing the Second Plane**

The lower plane, the Plane of Action, is where work actually gets done. In this plane teams are formed, projects are executed and leaders lead. The upper plan, the Plane of Observation, is where learning takes place. In this second plane, self-aware leaders consciously monitor events in the Plane of Action, notice their own behaviors and recognize the impact they have on the action. Insights are developed through observations in the moment, through after-action reflection, and by seeking feedback from outside observers who are able to provide objective input on the leaders’ behaviors. It is through this work in the plane of observation that leaders are able to adapt their behaviors to ensure that desired outcomes are produced.

Consistent with the transition from senior management to executive leadership, a new set of objectives were formulated for Segment 5 that stated that at its conclusion, participants would be in action:

**As leaders,**

- Equipped to execute their projects within a holistic leadership framework
- Able to operate simultaneously in the plane of action and the plane of observation

**As learners,**

- Prepared to view their projects as opportunities for trying new things and learning by doing
- Primed to continue asking leadership questions to stimulate further personal growth
To ensure that the guest speakers planned for Segment 5 reinforced the two-plane perspective, guidelines were established that requested them to reflect on their own learning in addition to telling their story, as illustrated in Figure 3.7.

- Tell a personal story about a project or challenge, and...
- After a brief description, address questions such as:
  - What assumptions did you make that turned out to be correct? Incorrect?
  - What was your biggest surprise?
  - How did you respond to the unexpected?
  - What did you try that you had never done before?
  - What happened as a result?
  - What risks did you take to grow as a leader?
  - What occurred outside your project that had an impact?
  - What was the most important leadership lesson you learned?

**Figure 3.7: Guidelines for Segment 5 Guest Speakers**

The program for Week 1 was then built with an emphasis on personal leadership development, systems thinking, spanning boundaries and leading strategic change. The program and schedule are provided in Figure 3.8.

**Figure 3.8: KLDP Week 1 Program and Schedule**

In addition to creating a revised plan for Segment 5, the joint SERC/DAU effort produced changes in the segments that were to follow. Specifically:

- The case studies for Week 2 of Segment 5 were rewritten to emphasize leadership learning, and the DAU prep for the guest speakers to emphasize the shift to executive leadership
- Additional tools were incorporated into the Segment 6 toolkit, along with feedback on content that would enable learners to quickly apply the Segment 5 concepts and tools to their capstone projects
- The 2-plane metaphor was introduced as a framework for Segment 6 to encourage the learners to view their capstone projects as experiments in leadership development and to emphasize the need for them to “learn while doing” as they led their project teams
The principles of executive leadership introduced in Segment 5 were incorporated into the design of Segment 7, and the focus of the Shark Tank experience broadened to include leadership reflection and learning in addition to project task learning.

3.5 KLDP SEGMENT 5, WEEK 1

The redesigned Week 1 of KLDP Segment 5 was conducted as a 5-day workshop at DAU Ft. Belvoir from March 14-18, 2016. Based on feedback from the learners, as well as observations made by the SERC instructors and the DAU faculty, the workshop was highly successful. When asked how well the material presented during the first week of Segment 5 helped them understand the difference between senior management and executive leadership, learner responses averaged 4.0 on a 5-point Likert scale. The same average response was obtained when learners were asked how prepared they felt after Segment 5 to lead their project teams. Positive comments in the learner feedback far outnumbered negative ones and every element was specifically cited as having been helpful at least once.

Learners also reported having grown both as leaders and as learners, consistent with the segment objectives. Their thoughtful and active engagement throughout the week on very challenging, out-of-their-comfort-zone learning experiences was markedly different from the learner engagement observed during Segment 3. Most learners demonstrated serious commitment to personal growth and enhanced confidence in their abilities to lead in emerging, complex and dynamic situations.

Post-course feedback from the learners after Segment 5 was far more favorable than received following Segment 3. Eighty-two percent of the respondents reported that the KLDP pilot had accelerated their transition to executive leadership by at least a year; fifty percent said it had done so by two years or more. As for the role the SERC instructors played in the first week of Segment 5, 86% of the respondents said they should be brought back for Pilot 2, a number that was roughly split equally between bringing them back as consultants to DAU instructors and bringing them back to teach.

As further evidence of the value of the KLDP program, by the end of Segment 5, ten of the learners reported they had assumed new positions of increased responsibility since the start of the program, and eight attributed that directly to their participation in the program. This was not only an endorsement of KLDP but it further validated the RT-4 hypothesis that the technical leadership capabilities of high potential, senior DoD systems engineers and technologists can be accelerated through an educational program in technical leadership.

4 FINDINGS, CONCLUSIONS & RECOMMENDATIONS

The success of week 1 of Segment 5 demonstrated that the research hypothesis for RT-140, that the SYS 350 B&C material developed and validated during RT4 Y4 can be leveraged as a key component of the larger Key Leadership Development Program (KLDP) being developed by DAU, was met. In addition, it further validated the RT-4 hypothesis that the technical leadership capabilities of high potential, senior DoD systems engineers and technologists can be accelerated through an educational program in technical leadership.

As discussed, however, the achievement of these results was not nearly as simple as had initially been envisioned. It required considerable redesign, not only of the SYS 350B&C material, but of other aspects
of the KLDP Program as well. Given what was learned, one would never want to repeat the process exactly as it was done in this research task. Rather, one would want to leverage the lessons from RT-140 into redesigning KLDP to ensure that executive leadership and systems thinking were introduced earlier in the program, in Segment 1. In doing so, the following recommendations are offered:

- Separate the leadership development modules in Segment 3 from the business modules, and move them earlier in the overall program to ensure that executive leadership is addressed from the beginning.
- Introduce the two-plane metaphor at the outset of the program to emphasize the need for leaders to continually learn from their experiences.
- Ensure that all guest speakers address not only what they did as they tell their stories, but also what they learned and how that learning was accomplished.
- Emphasize that the learning objective of the projects is as important as the results to be produced, and encourage learners to experiment with different leadership behaviors and techniques, and to observe the results.
- Include leadership development questions as an integral part of the project reviews in the “Shark Tank.”