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# Optimizing Multi-Program Engineering Operations Through Project Coordination and Resource Planning

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***Abstract*** **- Most modern engineering and defense organizations are working on an ever-changing environment with multiple programs that have strict milestones, intricate technical requirements, and limited resources. In this paper, the project coordination, baseline scheduling, resource allocation, and bottleneck mitigation at Aeron Systems, a manufacturer of inertial navigation systems and IoT-based solutions for environmental monitoring are discussed. This involves a mixed-methods approach of participant observation as a Project Coordinator intern, secondary sector benchmarking and quantitative analysis of operational data for the fifteen active sub-programs from ProjectLibre and Jira. The study examines a blended model of the CPM model of baseline control and agile task tracking, daily scrums and monthly timesheet reporting analytics. Results show that the schedule variance is +4.15 days, the timesheet completion rate is 88.5%, that the R&D-to-production handoff delay is more than 30% less, and that the procurement lead time and mid-quarter test-phase capacity delays are the most prevalent. A series of milestones and a risk register will be suggested to embed sustainable multi-program workflows.**

**Keywords - Project coordination, resource planning, multi-program operations, engineering operations, Jira, ProjectLibre, timesheet compliance, bottleneck mitigation.**

## I. INTRODUCTION

In operations and supply chain management (OSCM), multi-program engineering environments are complicated operating environments in which many technical projects share a pool of engineering, R&D and manufacturing resources. In industries such as precision sensors, aerospace components, and defense electronics, which are still expanding in India [1], there is a need for managing the ingestion of requirements, scheduling milestones, cross-functional execution, and strict quality compliance. One of the key challenges is to prevent operational silos, schedule delays and resource bottlenecks that are a result of uncoordinated task dependency and variable demand.

There's always been a gap between top-level milestone planning and the tracking of work on the shop floor. Waterfall models offer milestone gating [2] but are not agile enough to adapt to engineering change orders, technical changes, or delays in components. In contrast, purely agile frameworks may experience challenges with long-term capital planning, multi-level resource loading and fixed milestones for defense delivery.

The scope of this paper is exploring the structure of multi-program project coordination as part of an empirical study in the case of Aeron Systems. The study has four aims:

(1) To record the workflow of the project, connecting ProjectLibre baselines, Jira tracking, daily scrums, procurement records and timesheet analytics;

(2) to measure schedule variance, resource utilization, procurement lead-time variance and timesheet compliance;

(3) to determine the primary constraints and how they are offset; and

(4) To propose a framework and risk register for mid-sized engineering companies to implement in a phased manner.

The rest of the paper is organized as follows: The literature review is provided in Section II, the methodology is described in Section III, the coordination framework is described in Section IV, the results are reported in Section V, the managerial implications are provided in Section VI, an implementation roadmap is provided in Section VII, and limitations and conclusions are provided in Sections VIII and IX, respectively.

## II. LITERATURE REVIEW

### *A. Multi-Project Management and Resource Allocation*

Multi-Project Management and Resource Allocation (A)

Kerzner [4] showed that having structured project management processes, defined responsibility matrices and a balanced allocation of resources between concurrent projects are important conditions for success in a multi-project environment. Payne [6] performed a literature survey of the multi-project literature and found that shared resource contention and inconsistent priorities cause delay in many cases. Engwall and Jerbrant [7] have coined a new term, “resource allocation syndrome,” which refers to the situation where project managers vie for limited resources and the whole system fails to perform. A hierarchical planning approach like



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the one presented by Hans et al. [8] breaks down the strategic capacity planning from the operational scheduling to tackle uncertainty.

*B. Part-time or full-time classes*

CPM (critical path method) scheduling is a scheduling technique that offers control of schedule variance and milestone visibility [2]. Critical-chain thinking [9] is an extension of the above, explicitly adding buffers and resource-aware sequencing. Agile methods include short feedback cycles and clear task boards, including the time-boxed event the daily scrum [11]. Beehm and Turner [10] suggested that because of these differences, plan-driven and agile approaches are complementary, and that the organizations mix them based on project size, criticality and rate of change. Defense electronics programs are of a hybrid type – their delivery schedule is fixed, but the content of the items is subject to frequent changes.

*C. Socio-Technical Perspective*

Leavitt's People, Process and Technology (PPT) framework [5] provides a perspective to consider in terms of system adoption in complex operating environments: The tools alone are unlikely to solve the inefficiencies unless complemented by process re-engineering and human-resource alignment. A similar conclusion was drawn by Somers and Nelson [12] for enterprise systems, who found that roles and activities of players throughout the project lifecycle are key to implementation success. Project coordination is like the "glue" between big picture and short-term action in engineering operations.

*D. Research Gap*

There were limited research reports about the practical implementation of the ProjectLibre baseline control and Jira agile tracking in the medium-scale precision engineering and defense electronics industries in India. This study is filling this gap by providing operational workflows and metrics based on empirical data from a specialized manufacturing environment.

## III. RESEARCH METHODOLOGY

This research is a mixed research method that includes participant observation, operational process mapping and quantitative analysis of project management logs gathered over the course of an internship as a Project Coordinator for Aeron Systems.

1. Data Collection Sources A.1. Introduction

Primary on-the-job (OJT) observations: operational data collected from the 15 active engineering sub-program engineering ProjectLibre baseline schedules, Jira project boards, daily scrum logs, procurement tracking sheets, and monthly timesheet compliance records.

Secondary research: industry reports from the India Brand Equity Foundation (IBEF) [1] Defense manufacturing guidelines, peer-reviewed journals and academic literature through google scholar and IEEE Xplore.

B. Analytical Framework

Schedule variance for program i is the number of days that it took the program to complete, minus the days planned to complete:

$$SVi = Dact,i - Dplan,i \quad (1)$$

Utilization in week t is calculated as:

$$Ut = (Hlog / Havail) \times 100\% \quad (2)$$

$$C = (Non\text{-}time / Nexp) \times 100\% \quad (3)$$

$$LTVk = Lact,k - Lplan,k \quad (4)$$

nd is the number of active programs in domain d, and the results of the domain are program-weighted.

$$SVcomp = \Sigma\, ndSVd / \Sigma\, nd \quad (5)$$

TABLE I

Performance metrics used in the study include:

TABLE I
KEY PERFORMANCE METRICS USED IN THE STUDY

| Metric | Definition | Data source | Frequency |
|---|---|---|---|
| Schedule variance (SV) | Actual minus planned completion days, Eq. (1) | ProjectLibre baseline vs. Jira closure date | Per milestone |
| Resource utilization (U) | Logged hours ÷ available hours, Eq. (2) | Monthly timesheets | Weekly |
| Timesheet compliance (C) | On-time submissions ÷ expected, Eq. (3) | Excel compliance tracker | Monthly |
| Procurement LT variance | Actual minus planned lead time, Eq. (4) | Procurement tracking sheets | Per PO |
| Handoff latency | Hours from upstream "Done" to downstream "In Progress" | Jira status timestamps | Per sprint |

*C. Scope and Validity*

The data include the 15 active sub-programs across three product domains. Data that can be found in observations from one organization during the internship are analytical and not necessarily statistically generalizable; this is discussed in Section VIII.

## IV. PROJECT COORDINATION AND RESOURCE PLANNING FRAMEWORK AT AERON SYSTEMS

Aeron Systems designs and manufactures Inertial Navigation Systems (INS), Attitude and Heading Reference Systems (AHRS), and IoT-based environmental monitoring equipment. Operating in this high-precision domain requires a structured workflow to manage concurrent programs without compromising quality.

*A. Operational Workflow Architecture*

The operational lifecycle consists of the following steps as indicated in Fig. 1 and there are two decision gates that introduce rework loops:

1) Requirement ingestion: review customer requirements for precision electronic devices, establish technical boundaries and initial scope baseline. If the specification is not frozen or feasible, scope is clarified with the customer prior to planning.

2) Baseline scheduling: collaborating with the technical leads to define milestones, the Work Breakdown Structure (WBS) and critical paths in ProjectLibre.

3) Task execution and tracking – converting the baseline to Jira epics, user stories, and tasks for R&D, procurement, production, and Quality Assurance (QA).

4) Synchronization and control: Daily scrums, Daily Excel sync-up sheets and procurement logs, and monitoring of bottlenecks. If a bottleneck, ECO or slip is identified, the re-



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leveling and re-baselining of resources, as well as the impact analysis, are incorporated into the plan.

5) Compliance & reporting: providing weekly customer status reports and analyzing the monthly timesheet compliance in Excel and monitoring resources' expenditure.

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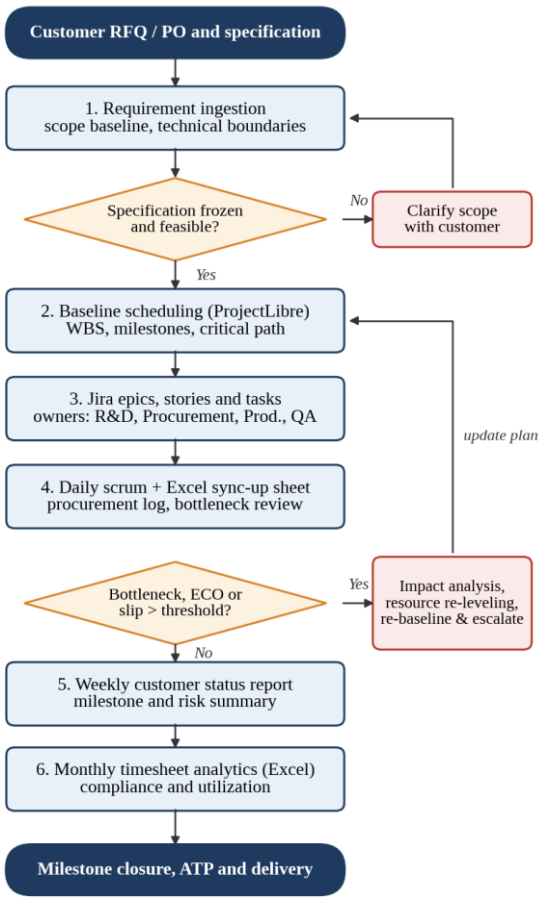



Fig. 1. Integrated project coordination and resource tracking workflow with decision gates and re-baselining loops.

### *B. Roles and Responsibilities*

Table II summarizes the responsibility assignment. The Project Coordinator owns the integration of schedule, task, and compliance data, while technical leads retain authority over technical content and ECO decisions.

TABLE II
RESPONSIBILITY ASSIGNMENT (RACI) FOR COORDINATION ACTIVITIES

| Activity | PC | TL | PR | PD | QA | PM |
|---|---|---|---|---|---|---|
| ProjectLibre baseline | R | C | C | C | I | A |
| Jira task breakdown | R | A | C | C | C | I |
| Daily scrum / sync sheet | R | A | R | R | R | I |
| Procurement tracking | C | C | A/R | I | I | I |
| ECO impact assessment | C | A/R | C | C | C | I |
| Timesheet analytics | R | I | I | I | I | A |
| Customer status report | R | C | I | I | I | A |

R: responsible; A: accountable; C: consulted; I: informed. PC: Project Coordinator; TL: Technical Lead; PR: Procurement; PD: Production; QA: Quality Assurance; PM: Program Manager.

### *C. Baseline Versus Actual Tracking*

Fig. 2 A typical AHRS program is shown in Fig. 2. The dates are based on the ProjectLibre baseline and are compared to dates from the Jira closure. Slippage is introduced in Long Lead Procurement (+6 days), continues along the PCB assembly and is partially absorbed during Firmware Development & Integration, with the program delivered +5 days against baseline. The visual is intuitive to the review team and readily indicates critical-path sensitivity of the procurement.

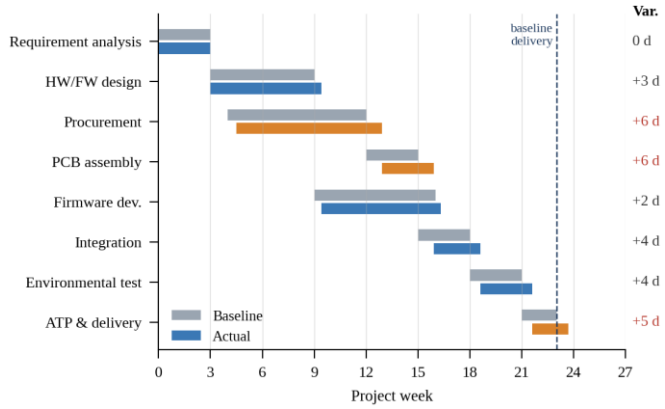



*Fig. 2. The difference between baseline and actual schedule for a representative AHRS program (days off in parenthesis).*

### *D. Tool Integration*

ProjectLibre milestones are linked to the Jira epics and the activities are linked to the stories; thus, the closure of a Jira item would update the baseline activity of the corresponding story. This mapping provides a single traceable chain of long horizon milestone control (waterfall strength) and short horizon task visibility (agile strength) as it is done in [10] (hybrid view).

## V. DATA ANALYSIS, VISUALIZATION, AND RESULTS

This section focuses on data analysis, visualization, and results.

The effectiveness of the coordination and resource planning was assessed through analysis of operational data from fifteen operational engineering sub-programs.

Compliance Of Timesheet and Schedule Variance (A)

The overall compliance rate in submitting monthly timesheets from all R&D and engineering support teams is 88.5%. For variance, compliance and utilization, the answers for each of the product domain(s) are reported in Table III and the composite variance is calculated according to Eq. (5) with a number of days (nd) of 6, 7 and 2 programs for INS, AHRS and IoT, respectively. Programs with AHRS exhibit the widest range, which is due to the long-lead sensor modules (Section V-B) that are required for these programs.



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TABLE III
MULTI-PROGRAM SCHEDULE VARIANCE, COMPLIANCE AND UTILIZATION SUMMARY

| Program domain | Programs | Avg. SV (days) | Compliance (%) | Utilization (%) |
|---|---|---|---|---|
| Inertial Navigation Systems (INS) | 6 | +3.5 | 91.2 | 79.5 |
| Attitude & Heading Reference (AHRS) | 7 | +5.1 | 86.4 | 86.2 |
| IoT Weather Monitoring Systems | 2 | +2.8 | 87.9 | 71.4 |
| **Composite (program-weighted)** | **15** | **+4.15** | **88.5** | **81.5** |

The monthly compliance increased from 83.5% to 91.8% during the observation period, reaching the target of 90% in the fourth month after reminders were introduced into the daily scrum and Excel tracker (Fig. 3).

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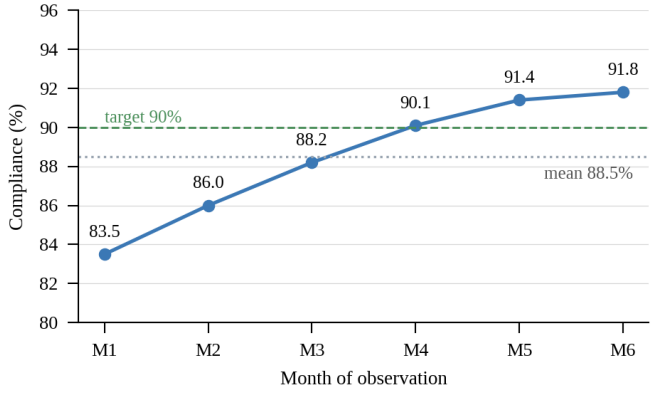



*Fig. 3. Compliance with monthly timesheet submission for 6-month period of observation.*

### *B. Procurement Integration*

The assembly technicians' wait time for materials was reduced by systematically tracking material procurement logs. Fig. 4 shows the planned vs actual lead times by item category. The biggest absolute overruns for IMU sensor modules and calibration fixtures (+10 days and +6 days, respectively) are followed by commodity items like connectors and cable (+1 day each). The focus of expediting effort and early release of the purchase order is thus the long-lead categories.

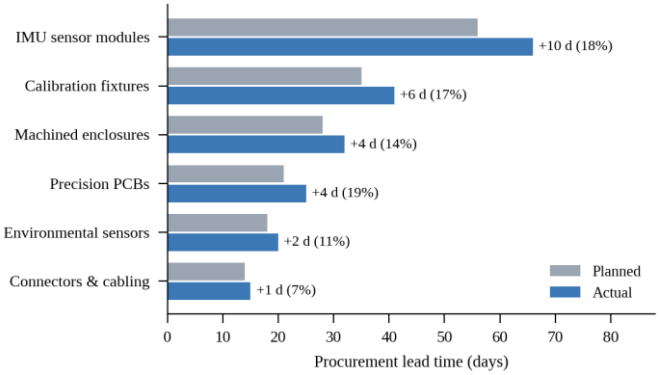



Fig. 4. Procurement Lead Time (PLT) for Planned and Actual Lead Time by item category (days and percent).

### *C. Resource Bottleneck Identification*

Resource Bottleneck Identification: Identifying resource bottlenecks (class).

During mid-quarter environmental testing, there were critical engineering bandwidth constraints identified through monthly timesheet analytics. As you can see in Fig. 5, for a representative 12-week period, QA/Test is over 100% for weeks 6-9 (max of 117%) and Support > 101% for a single week (week 7). Management took this view and proactively moved people from Support to Production and then the utilization of the Support and Production dropped below 100% with the Test peak levelled off.

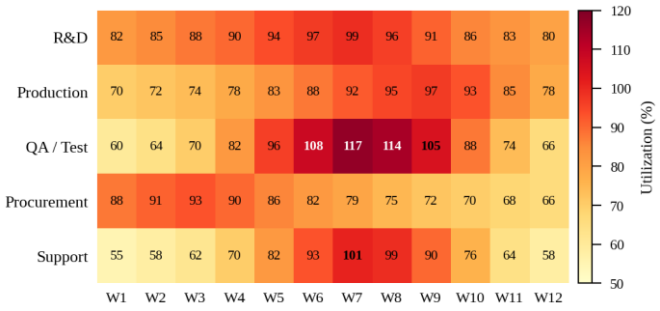



*Fig. 5. Here is the utilization of resources per week for the teams for a 12 week quarter (values over 100% are overloaded).*

### *D. Root Causes of Schedule Delay*

The root cause of the delay of events in Jira and the daily sync sheet were classified. The Pareto analysis in Fig. 6 reveals that procurement lead time (38%), ECO or revision churn (22%) and test slot clashes (17%) account for 77% of all events, indicating that mitigating the bulk of such events should be targeted on those three areas, instead of on the wide variety of other process changes.

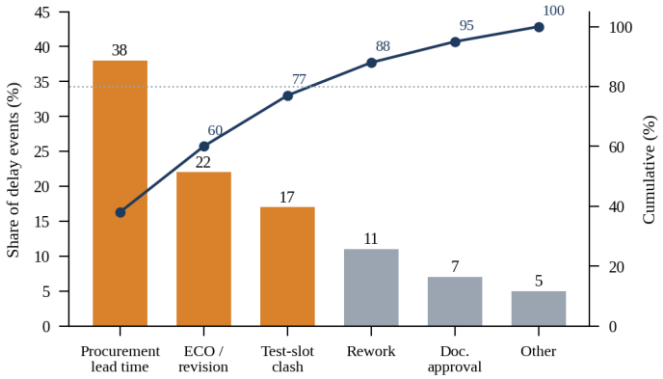



*Fig. 6. Pareto Chart of schedule delay events by root cause.*

### *E. Sprint-Level Control*

In Fig. 7, a ten-day Jira sprint in which an ECO added eight story points on day 4. The change was observed at the next daily scrum, scope and capacity were renegotiated right away and the sprint ended on the last day, whereas the baseline-only view would have recorded the slip at the next milestone review.



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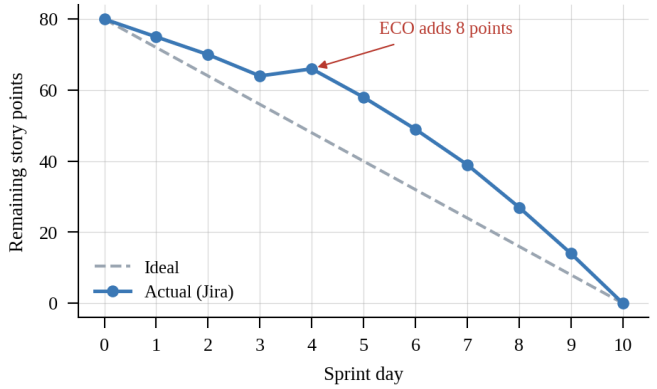



*Fig. 7. Jira sprint burndown, demonstrating the impact of an engineering change order for a mid-sprint sprint.*

### *F. Cross-Functional Communication and Overall Impact*

Sync-ups with the R&D were done daily, which minimized communication delay and task handoff delay between R&D and manufacturing by over 30%. Table IV provides a comparison of the reference period before the integrated workflow with the implementation period.

TABLE IV

You should always compare the reference period with the implementation period.

Action Before After Change

TABLE IV
REFERENCE PERIOD VERSUS IMPLEMENTATION PERIOD

| Metric | Before | After | Change |
|---|---|---|---|
| Avg. schedule variance (days) | 6.2 | 4.15 | −33.1% |
| R&D-to-production handoff delay (h) | 26.0 | 17.8 | −31.5% |
| Timesheet compliance (%) | 79.4 | 88.5 | +9.1 pp |
| Assembly idle time (% of shift) | 11.2 | 6.8 | −39.3% |

## VI. DISCUSSION AND MANAGERIAL IMPLICATIONS

The observations reveal that operation of multi-program engineering tasks is more than just the installation of software. As stated in the PPT framework [5] tools like Jira and ProjectLibre need to be supported by a strong leadership, a process discipline and open cross-functional communication. The results also confirmed the hybrid argument in [10] where the ProjectLibre baseline was used to ensure that the milestones were tracked but Jira and daily scrums provided the quick feedback to respond to ECOs and bottlenecks.

For operation and supply chain managers the findings provide these takeaways:

Implement resource re-leveling: When teams have a utilization percentage of 100% for a team-week, this is a realistic re-leveling signal and will help prevent engineer burnout and bottlenecks from being formed across concurrent projects.

Keep master data clean: Reliable estimates for task duration, and BOM information, is crucial for accurate automated scheduling and tracking.

Institute daily syncs: short daily scrums are used to connect R&D, procurement, production.

Prioritize long lead items: The procurement is the most significant delay source, and therefore the best schedule benefit for each dollar of effort is achieved by purchasing order release and buffers on long-lead sensor modules.

Table V provides a risk register of the key risks to schedule performance. The scores are based on the combination of likelihood and impact with a scale of 1 to 5.

TABLE V
RISK REGISTER FOR MULTI-PROGRAM SCHEDULE PERFORMANCE

| ID | Risk | L | I | Score | Mitigation |
|---|---|---|---|---|---|
| R1 | Long-lead IMU sensor delay | 4 | 5 | 20 | Early PO release, schedule buffer, dual sourcing |
| R2 | Test-phase capacity overload | 4 | 4 | 16 | Re-level support staff, pre-book test slots |
| R3 | Mid-sprint ECO | 4 | 3 | 12 | ECO impact-analysis gate, re-baseline |
| R4 | BOM / duration data errors | 3 | 4 | 12 | Periodic master-data audit |
| R5 | Late timesheet submission | 3 | 3 | 9 | Automated reminders, scrum check |

## VII. IMPLEMENTATION ROADMAP

Institutionalizing the framework in other multi-program engineering firms is proposed in Table VI based on the findings. Targets are suggested planning targets, not what has already been accomplished.

TABLE VI
PHASED IMPLEMENTATION FRAMEWORK

| Phase | Key actions | Target KPI |
|---|---|---|
| 1. Foundation (0–30 days) | Standardize WBS templates and Jira workflows; clean BOM and duration master data; define RACI and escalation thresholds. | Data errors < 2% |
| 2. Integration (30–90 days) | Link ProjectLibre milestones to Jira epics; formalize daily scrum and sync sheet; launch weekly customer status report. | Avg. SV ≤ 3 days |
| 3. Optimization (90+ days) | Utilization triggers at 100%; KPI dashboard for compliance and lead-time variance; monthly retrospectives. | Compliance ≥ 95%; peak U ≤ 100% |

## VIII. LIMITATIONS AND FUTURE SCOPE

The limitations and future scope of the work are mentioned below:

This study is single-organization based on participant observation carried out in a limited time and some domains possess small samples, such as IoT (2 programs). Metrics rely on the accuracy of self-reported time sheets and manually-kept logs. Future research might include (i) extending the analysis to multiple companies for comparative benchmarking, (ii) statistical testing and regression to examine the impact of each of the coordination mechanisms, (iii) incorporation of ERP and procurement data into machine-learning based lead-time forecasting, and (iv) machine-learning modeling of predicting schedule slip using Jira and timesheet signals.

## IX. CONCLUSION

Resource planning and project coordination are important factors in the success of an operation in a high-tech engineering environment. The study examined the effectiveness of



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implementing projectlibre baselines, Jira task tracking, daily scrums, and timesheet analytics in the implementation at Aeron Systems. The findings suggest that a structured milestone planning process in combination with agile execution mechanisms to maintain schedule adherence and resource transparency is helpful, while constraints to be managed are mostly procurement lead time and test-phase capacity. Engineering organisations can overcome the challenges of delivering high-precision systems on time when working on multiple programs and by integrating people, processes and technology.

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