Partners in Productivity

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D R A F T

Executive Project Overview

Integration of Factory Analytics at Nolte Manufacturing

A Nolte Precise Manufacturing - Sight Machine Collaboration, as a step towards making Nolte Manufacturing company a 'smart factory'

Submitted By:

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Overview- Integration of Factory Analytics at Nolte Manufacturing

Proposal: To build a digital manufacturing system for Nolte leveraging real-time smart factory analytics through collaboration with Sight Machines Analytics.

Business Rationale:

1. As Nolte's mission is to become its client's ideal supplier through superior service and value that lower's client ownership, Nolte needs to continue to evolve , adapt and innovate to remain an industry leader. Therefore, Nolte needs to evaluate its entire manufacturing process and needs to find efficiency in reduction of total cost of ownership
2. Nolte's manufacturing processes are discrete and hence need help to address critical challenges in quality and productivity throughout the enterprise for clients, including process and engineering reviews to incorporate the most efficient business practices and utilizing the newest technology and equipment's possible
3. Nolte needs to make better ,faster decisions about its manufacturing operations through real- time visibility and generate actionable insights for every machine, line and plant throughout the enterprise
4. Nolte's customers' needs are constantly changing and evolving and as our customers look for services beyond parts procurement, we want to excel at offering innovative supply chain solutions

Aim of this project:

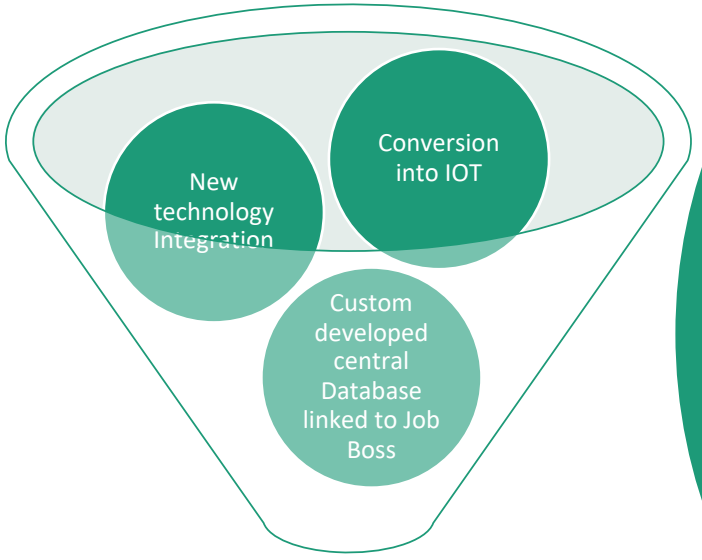
- This project is hence established to lay out an initial concept of a first-phase trial of smart-factory technology. The purpose of this project is to build digital manufacturing system by delivering advanced analytics for improved productivity, quality and supply chain optimization.
- Through this project's integration of factory analytics at Nolte Manufacturing with Sight Machines, Nolte will be equipped with the most advanced technology such as big data analytics, and hence will be able to supply a broad range of specialized parts and assembled components to its customers. Moreover, Nolte will be able to provide excellent service, on-time delivery, and realize peace of mind in critical processes such as supply chain management. Such visibility into accurate and timely operations data is a key step to improving productivity and quality.
- This project is going to be a one of the best return on investments to Nolte as by integrating Factory Analytics based on big data analytics would provide a remarkable entry-point to exploit the wonders of such impressive technology.
- By integrating Sight Machine factory analytics with the existing framework, Nolte, will be able to fulfill the promise of being able to provide a total cost solution to our customer's parts needs and supply chain requirements.

High-level overview of the project:

To achieve our goals, following **process deliverables** have been envisioned:

- A detailed project integration plan confirming the goals and specific information about all stakeholders including a charter/scope document and WBS
- A project overview presentation for board of directors and executives held today.
- Development of a new user training schedule for shift supervisors and CNC machine operators well in advance
- Scheduled meetings on quality management approaches/test plan development, project risks and mitigation strategies for cross impacted areas of the company.
- Budgetary estimates of expected costs

Product Deliverables:



Product cost analysis report

Employee efficiency analysis report

Profit analysis by product report

Conversion into IOT

- We will begin with the initial roll out where we will be implementing the new technology on **34 computer based machines** including CNC Milling, Swiss Machining and CNC Lathe Turning equipment

New technology Integration

- Next, after we are done converting these into IoT technologies, the machines will be interconnected with each other over a network connected to Sight Machine Analytics software.

Custom developed central Database

- We plan to develop an extract from the system and link it to the existing Job Boss manufacturing control system to develop **a custom financial analysis database** which will be able to generate following reports:
  - Product cost analysis
  - Employee efficiency analysis
  - Profit analysis by product
- Sight Machine will provide **cloud based storage** of this data collected

Vision Of the Project for Nolte Precise Manufacturing Company

- **Enterprise Manufacturing Visibility :** The new technology brought in by this project into Nolte's manufacturing line if implemented enterprise wide help improve throughput by analyzing bottlenecks, reduce scrap rate by analyzing process. Real-time visibility of factory and machine performance from across your company will be delivered on an intelligent, secure, and scalable platform by predicting failures, monitoring historical data, trends and manufacturing specific algorithms to proactively manage asset failures.
- Nolte will be able to manufacture precision machined parts and assembled components that improve our client's product's quality, Nolte will continue to stay as a trusted partner for manufacturers from various industries.
- Nolte will be able to establish new & better business practices that will be different from before by using the advantages of **Global Operations View-** A real-time, enterprise view of machine operation and output across all Nolte's plants, and
- Using **Data Views** ability after the implementation of this project , Nolte will be able to view highly **c**ontextualized data from repository links between specific machine data and plant operations, providing an integrated view of Nolte's operations
- Through integration, new IOT technology based hardware will be installed to the plant floor which will collect real time data across the enterprise through Sight machines software. After this integration is implemented, Nolte will have access to reliable Overall equipment effectiveness (**OEE**) metrics, automatically generated from audited data sources.

Technology Outcomes:

Equipment and Software products built/utilized during this project :

- Initially, 34 machines in Nolte's manufacturing line will be utilized to participate in this first roll out of project and will be converted into IOT technology needed for SM analytics software.
- **Plant Digital Twin:** A dynamic mirror image of plant, lines, machines , products and processes that produces a comprehensive, real-time semantic context of process and product data.
- An extract from the integrated system will get linked to the existing Job Boss manufacturing control system to develop a custom financial analysis database which will be able to generate following reports:
  - Product cost analysis
  - Employee efficiency analysis
  - Profit analysis by product
- **Productivity Application Suite** -Turnkey analytic suite for improving OEE/throughput including the ability to analyze bottlenecks, downtime, and asset failures
- **Quality Application Suite** -Out of the box applications to Improve first-pass yield, reduce scrap, and identify the root causes of quality issues

Changes envisioned for Nolte's Staff:

- This project will change the way how Nolte evaluates its client's entire manufacturing process, finds and recommends efficiencies through incorporation of latest big data analytics into its core system.
- While Nolte remains true to its founder's value system, it understands the value in evolving, adapting and innovating itself to remain an industry leader. This project will hence, empower its staff with tools to visualize real-time results on purpose-built dashboards and discover actionable insights which will reduce manual effort and increase efficiency.
- Nolte is proud of its much experienced staff and takes their skillset enhancement seriously and this project will be a great opportunity for Nolte's employees to get exposed to some of this decade's biggest innovations in the field of Big Data and Predictive analytics.
- With the constant changes in technology, the current skills may become outdated soon and by utilizing the chance to participate in this opportunity, Nolte's workforce will be taking advantage of once in a lifetime opportunity to invest in the future of manufacturing systems .
- By gaining relevant market skills , this project's effort combined with exposure to the leader in this field for Nolte's size company- Sight Machines, may help to reduce some of the much needed skills gap

Changes envisioned for the customers of the organization:

This shift will have a serious impact on manufacturers and on their supply chain relationships.

- Through the enterprise wide implementation, Nolte will be able to offer competitive pricing to its customers due to bulk automated production, reduction in failures/waste and manual labor cost.
- Nolte will be able to help its customers improve their inventory management processes through automation and real time monitoring of its products through the new custom developed central database software and the three special financial reports generated from it that will be unique to Nolte manufacturing .
- Much better alignment with its client's schedules, Nolte will be able to welcome any last minute requests due to lesser manufacturing time and hence better flexibility.
- Nolte will be able to offer innovative supply chain solutions beyond manufacturing precision parts
- Nolte will also be able to provide a total cost solution to its customer's manufacturing line's parts needs.

Strategic Advantages of this Project:

Integrating analytics with Nolte's manufacturing will bring about be a complete transformation for Nolte .The expected outcomes in the overall scenario of the company if the outcomes of this project are implemented across the organization will be tremendous. Integrating latest IoT technologies and analytics platform will benefit the organization in multiple ways:

- ✓ ***Better information capture and availability:*** By capturing and visualizing detailed, real-time information about the performance of its components, machines, lines, and unit, Nolte will be able to track each product's production lineage across machines. Observing and visualizing macro and micro trends of performance along critical metrics such as, like OEE, first-pass yield, and scrap rates will be made possible through this project's implementation.

- ✓ ***Improved quality and throughput of machines, lines, and units:*** Using advanced analytics will help to predict different component failures and hence will contribute towards foretelling machine downtime. Use of advanced analytics will also help to mine out machines, components, and parameters especially the ones which are result in below-par performance. Applying advanced analytics and software technologies will benefit Nolte to set up processes to identify, monitor and alert on occurrence of anomalous process parameters. Hence, Such comprehensive and curated information about all Nolte's products will be maintained and monitored in real time Such information collected can also be benchmarked and compare with other machines, lines, and plants at Nolte to drive continuous improvement.

- ✓ Further it ***will improve performance on multiple metrics*** such as
  - Failure rate
  - Scrap costs
  - Successful Production schedule execution
  - Labor costs
  - Early failure detection and prevention
  - Data correctness and collection
  - making our manufacturing processes faster and optimal with much lesser failure rate.
  - We will be able to see a reduction in total cost of ownership for our clients, including process and engineering reviews, inventory management, and assembly of our precise parts.

- ✓ By sorting through and making sense of previously unviewed data, Nolte with help from Sight Machines will be able to gain a faster, more accurate view of root cause analysis, statistical process control, anomaly detection, and other resource- and time-related issues.

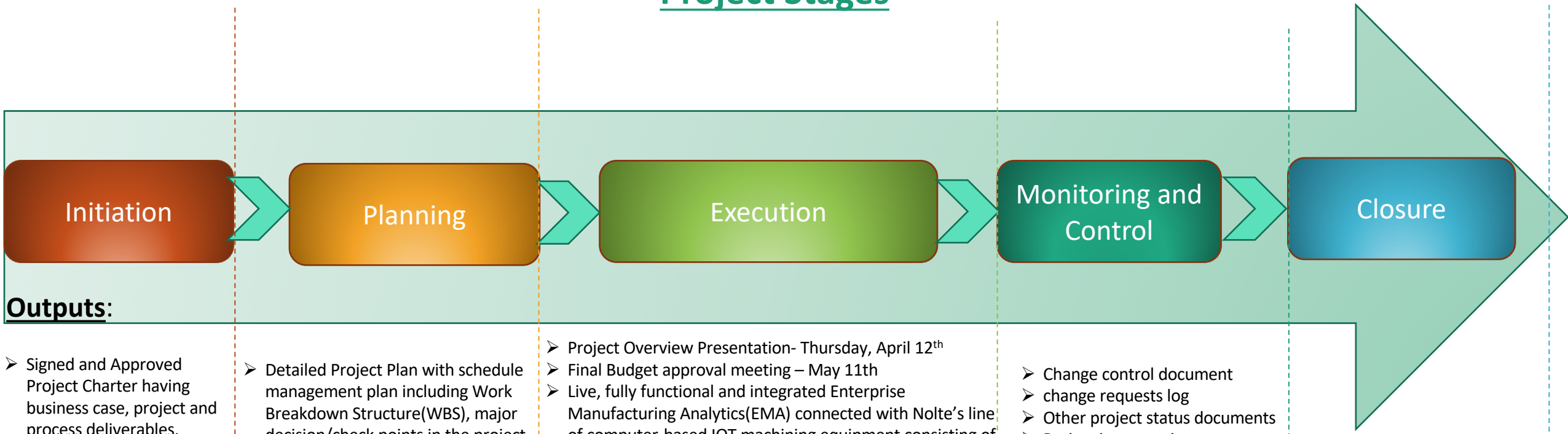
Scheduling Assumptions/Dependencies:

- Charter/Scope Document was approved and a contract between Sight Machines and Nolte has been already developed and signed .
- This presentation assumes that the company will have the required budget by April 30th to carry out this project's activities.
- Technology: It is assumed that Sight Machine Analytics software is purpose built to solve Nolte Manufacturing's challenges and is configured to handle data as fast as required by Nolte.
- A key outcome of factory wide implementation of this project by Nolte will depend on the whether Sight Machine will help in delivering supply-chain-wide visibility i.e., deliver insights from across the entire supply chain. This will be decided on the basis of successful outcomes of this project.
- It is assumed that the big data analytics technology integration is going to bring a positive result by being able to combine process and product data, get the right results faster, in real-time using techniques such as *Artificial Intelligence, advanced analytics* and *Machine Learning*.
- Success of this project depends on the fact that Sight Machine integration will be able to deliver improvement on variety of KPIs, including uptime, OEE, performance, quality, top defect types, top downtime reasons, average cycle time, etc. and will be hence be able to improve productivity and its going to increase efficiency and bring value to the company
- It is assumed that proper and timely documentation will be prepared before, generated after and during each phase of project implementation.
- It is assumed that the any challenges or risks faced during the project would be dealt in the best interest of Nolte Manufacturing.
- Third party organization involved: **Job Boss-** This project highly depends on the fact that EMA will be able to be integrated with the existing Job Boss manufacturing control system framework.
- Human Resources: Task duration, provisions for re-work, milestones achieved and Project success will depend on availability of resources and coordination of efforts between the project teams and individuals or groups mentioned in project plan documentation from both Nolte Precise Manufacturing including Job Boss control system and Sight Machines Analytics.
- Security: Sight Machine will keep Nolte's data secure and in any event, Nolte will have the ultimate ownership of its data , even after work is discontinued with Sight Machines
- All possible risks will have been identified before the initiation of this project including any areas possibly affected over the course of this project. There will be continuous monitoring and control until the closure of the project.

Scheduling Limitations/Constraints:

- Before getting started, Nolte and Sight Machines will have identified a potential list of specific projects- (34 machines in this project roll out)
- SM will have gained an understanding of the data sources we'll be working with – including machines, databases, and systems
- Before implementing SM analytics software, Nolte and SM will confirm the goals and specific information that stakeholders – executives, operations managers, and QA professionals – require
- Sight Machines will provide cloud based data storage assistance to Nolte
- It will be ensured that shift supervisors and CNC machine operators are scheduled for Sight Machine training well in advance of final implementation
- Executive Overview presentation will be held on Thursday, April 12th instead of May 11th.
- Sight Machines requires time for initial deployment (typically 60 days).
- Separate budget meeting with just the board in attendance will be held on May 11th and all details regarding full budget or detailed project dates will be reviewed on this date
- Final Implementation step will start on June 1, 2018 and continue beyond this until completion following an all approved project plan and budget.

Project Stages



Outputs:

- Signed and Approved Project Charter having business case, project and process deliverables, requirements and agenda
- Preliminary Budget proposal document with Cost estimates- By April 30th
- MOM's from the meetings added to project documentation

- Detailed Project Plan with schedule management plan including Work Breakdown Structure(WBS), major decision/check points in the project duration, refined project parameters, communication plan, risk analysis and management plan etc.

- Project Overview Presentation- Thursday, April 12th
- Final Budget approval meeting – May 11th
- Live, fully functional and integrated Enterprise Manufacturing Analytics(EMA) connected with Nolte's line of computer-based IOT machining equipment consisting of 34 machines
- Digital twin model of manufacturing line in scope created to collect data for all 34 machines
- Sight Machine software integrated to Job Boss.
- Custom database developed that enables three reports:
  -Product Cost Analysis
  -Employee Efficiency Analysis
  -Profit Analysis by Product
- QA and QC Testing-Issue log and defect traceability matrix, testing report on results and potential impact/risks if prototype is fully rolled out
- Project implementation document
- Cloud-based storage assistance provided by Sight Machine.
- Ensure shift supervisors and CNC machine operators are scheduled for Sight Machine training

- Change control document
- change requests log
- Other project status documents
- Project issues register
- Documents and procedures for continuous support for Nolte's end users after project end.
- First implementation –June1,2018

- Performance summary reports generated
- Lessons Learnt Report
- Final project closure meeting
- Final Report and other project closing documentation

Quality Planning, Quality Assurance and Quality Control Approaches:

Product Quality Assurance Testing :

- QA Team will create and execute extensive periodic test plans for testing and verification of the data in collected by the prototype built out of Nolte's 34 machines
- Quality assurance testing will identify failures and issues and ensure that all IOT's are efficiently working with Sight Machine's big data analytics platform and understand if any cross functional impact on any other Nolte's components
- Actions plans will be generated if any defects/bugs are found and sufficient time buffer will be provided for fixing these issues. Once discovered, they will be scheduled according to priority and severity and dealt accordingly.
- It must be ensured that no failure occurs in testing of any of the project components and must verify every technical aspect of the project.
- All bugs will be tracked to closure to ensure no more issues are there and recorded in defect traceability matrix reports for future reference
- Regression tests(manual and automated) will be created and run periodically and every time any changes are made to ensure that any patches or fixes do not produce and impact cross functionally on Nolte's other components.

Process Quality Assurance and Quality Control:

- Comparison of QA results with the baseline quality standards as mentioned in the project plan
- All phases of testing will be performed and reports will be generated with results from each phase.(Unit testing, Integration Testing, User Acceptance Testing, Performance Testing, Production Release Testing)
- All involved stakeholders will meet regularly to manage and assign any re-work produced(incase of issues found)
- All stakeholders involved will communicate regularly with one another and follow all quality standards and metrics established to be achieved during testing phase
- Extensive test reports will be generated on test results including potential impact/risks if prototype is fully rolled out
- Stakeholder review will be done after QA phase and Project go/no-go decision will be taken by Nolte after testing and before final implementation phase
- Project audits and periodic procedural reviews will be carried out and stakeholder feedback reviews will be conducted
- An Issue log will be maintained with a defect traceability matrix

Executive Involvement and Support Needed

Nolte Precise Manufacturing:

- Doug Coster, *President,* Nolte, to approve the project plan and cost estimates to sponsor the project
- *VP*, Finance ,Greg Harrison, to act as the final point of Contact at Nolte Precise Manufacturing & also sponsor the project.
- *Production Manager ,*Norma Wilson, to Sponsor the project and oversee procurement of computer-based machining equipment
- *VP* of Sales ,Mat Jackson, to sponsor the project
- Apurva Sharma, *Project Manager* will be in charge of the project, its schedule and deliverables and will be the primary point of contact from Nolte's side.
- *Manufacturing Process engineer,* Ray Bellman to sign off on the procurement of 34 CNC Milling, Swiss Machining and CNC Lathe Turning equipment which will be used to convert to IOT technologies needed for the Sight Machines analytics equipment. Ray will also oversee the installation of Sight Machines analytics software data with chosen Nolte's equipment
- *Manufacturing System Analyst,* Mary Gibson and her team of analysts will be accountable for performing Sight Machines integration analysis and inform Apurva Sharma on the performance reports from each phase of the project cycle.
- June Peterson and his team will be in charge of the custom developed database for Nolte and will oversee the three special reports generated from it. The status of the generation of these reports will be regularly informed to Apurva Sharma, and then will be produced for financial analysis in front of Greg Harrison, VP, Finance.
- Christina Kutty (*Senior Testing Specialist*) and her team will be responsible to carry out all Quality Assurance ,planning and quality control related activities for this project . She will also be responsible to maintain QA test results reports and defect logs and their traceability matrix. She will regularly stay in touch with Apurva Sharma, the project manager to keep her informed of the testing progress and will involve in all testing rework related activities.
- *Senior Programmer,* Lament Wilson and his team will be part of the development team and will carry out all code programming related activities to make sure all the product deliverables are met with the quality standards and will consult with other stakeholders on development status meetings and bug-fixes/patches development.

From Sight Machine Technology Staff:

- Chris Dobbrow, *SVP*, Sales will be the final decision maker from Sight Machines
- Kurt DeMaagd *(Vice-President Analytics),* Ryan Smith (*Vice-President Engineering*) and Curtis Kellman *(Client Implementation Tech. Analyst*) will be some of the key vendor contacts from Sight Machine Analytics involved in this project for Nolte.

Thank You.

Are you ready ? **Any questions?**

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