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Prisma

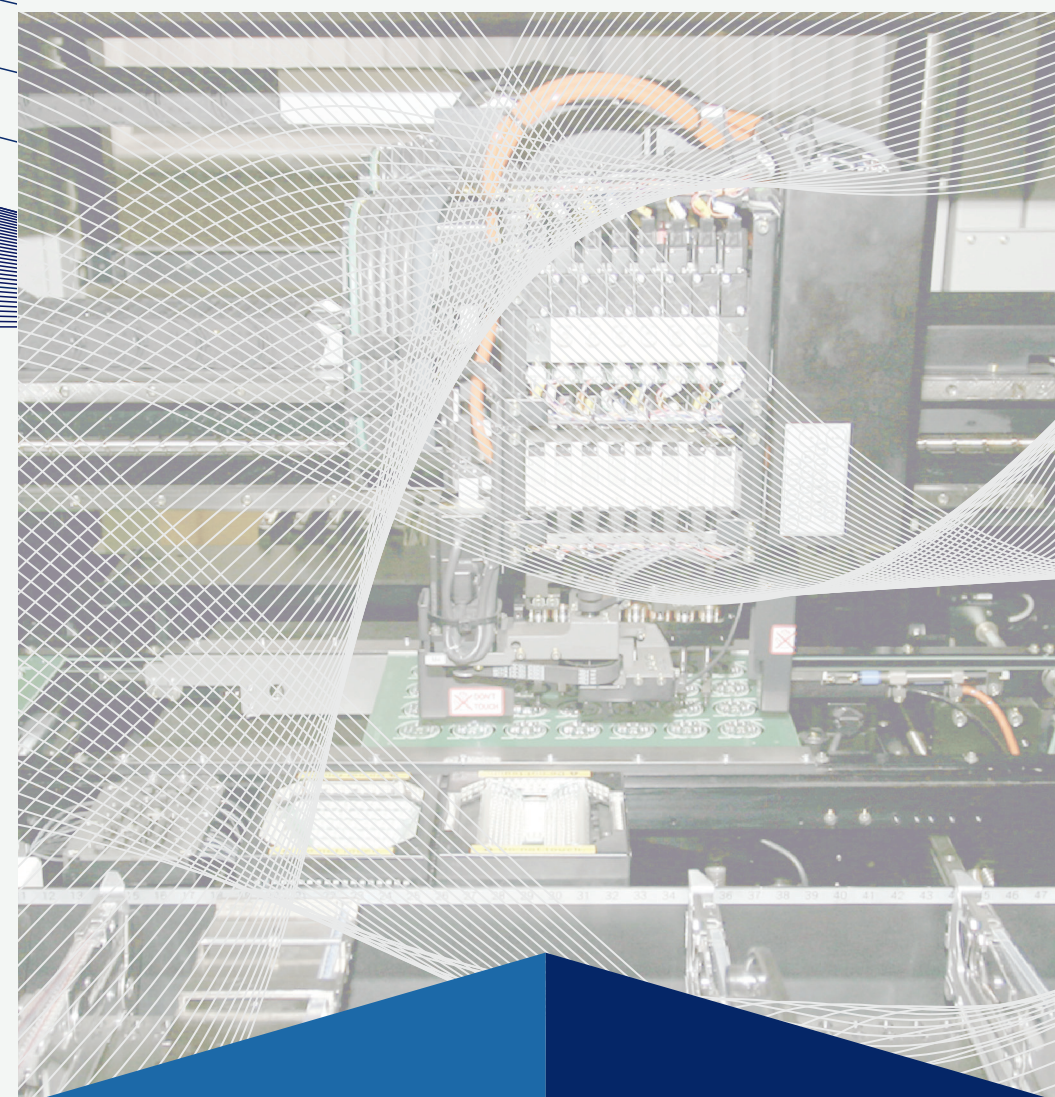
Discrete Manufacturing
Execution System



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Dukhov Automatics Research Institute (VNIIA),
Federal State Unitary Enterprise

www.vniia.ru





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Prisma

Discrete Manufacturing
Execution System

Prisma Automated Discrete Manufacturing Execution System (ADMES) is a tool which is used to manage an enterprise, including production, scientific and preproduction development, economic activity and material support of all the activities.

Prisma ADMES is designed to manage all processes of discrete manufacturing at large- and medium-scale enterprises with piece, low-batch and batch manufacturing. It includes a full range of solutions in this field. A closed multi-level planning system is implemented.

Prisma ADMES | Main Features

Prisma ADMES allows to:



Manage stock of orders



Implement Master Production Schedule



Prepare and manage product components



Launch products based on its date of issue, shop-to-shop flow sheet and process charts



Dispatch production of parts, assembly units and the item at level of shift tasks and data from equipment sensors



Prepare and provide an enterprise with parts and materials



Make a batch inventory of all goods and materials at enterprise's central storehouses and department stockrooms

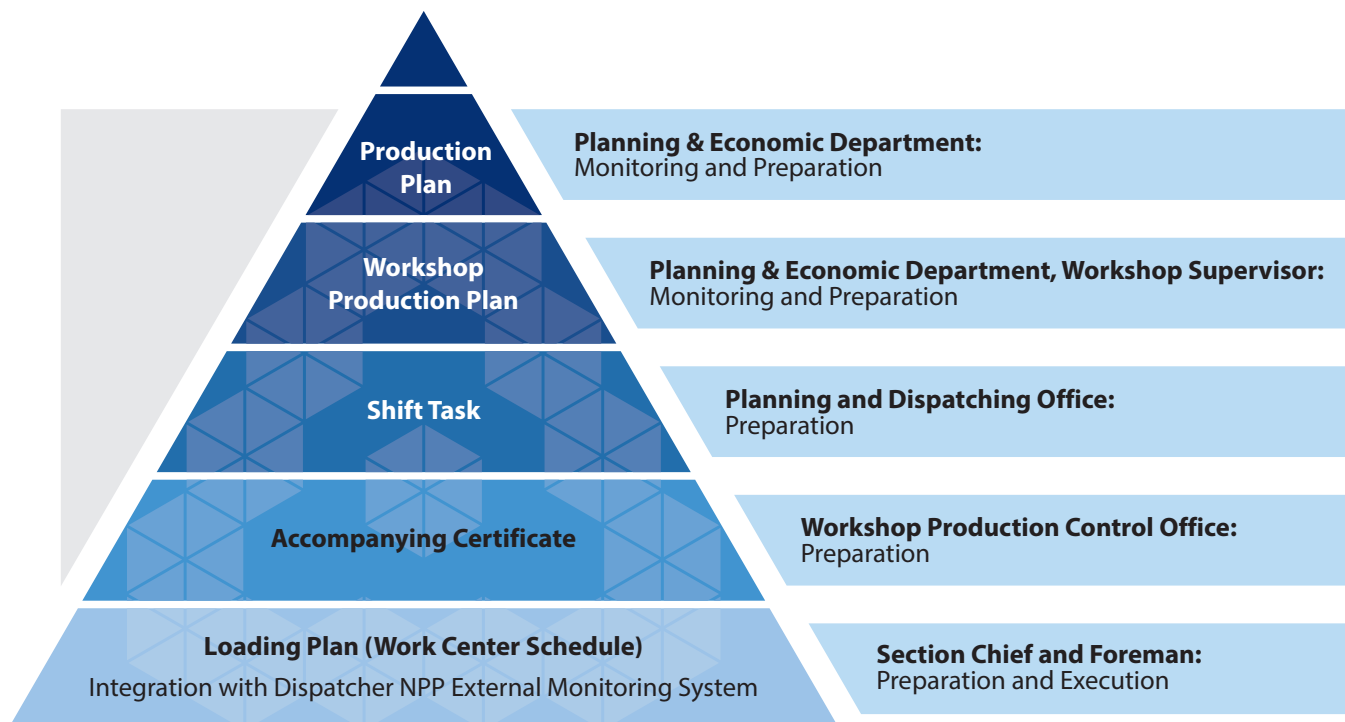
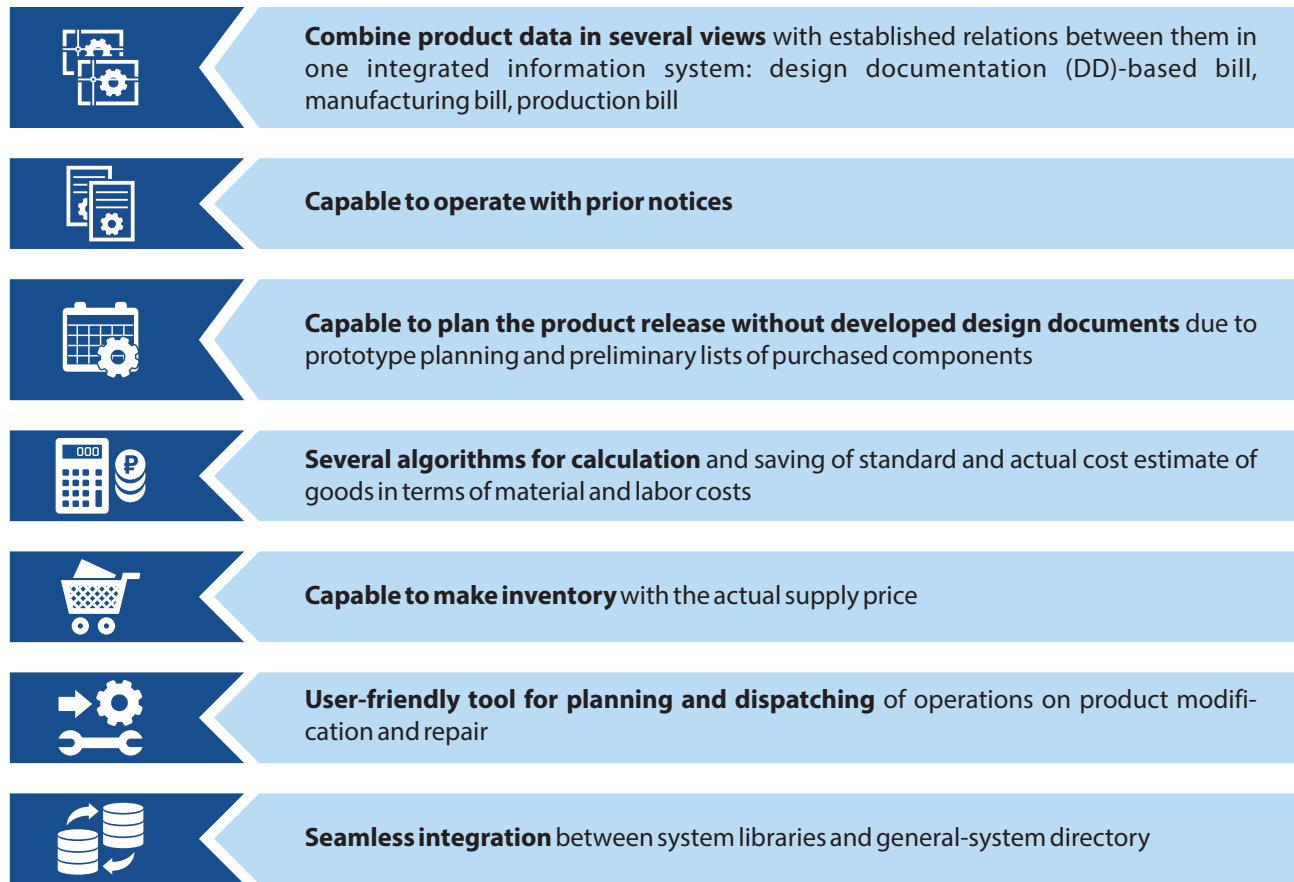


Make an inventory of half-end and end products



Manage the quality of products

Prisma ADMES | Key Benefits





Differentiation of privileged access

Various setup functions for user account to differentiate access to functional capabilities of the system.



Individual Workstation Interface

To make the system as user-friendly as possible the user can customize the interface.



Workstation

Accumulation of all necessary production data (accompanying certificate, drawing, roadmap) with all latest updates, which can be displayed for production department. It is possible to use the same data on several workstations at the same time.



Traceability of Products

Full production history: from arrival of parts to putting end products to the storage location with storing production solutions.



Barcoding

All electronic documents of the system have a barcode, which allows speeding up the searching process and data processing.



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Discrete Manufacturing
Execution System

Management of reference data

Product bills, shop-to-shop flow sheet,
technology, manufacturing standards,
brought-in products, orders, equipment,
counterparties

Management of
approved product
documentation

Development and
planning of process tools

Production management
of process tools

Planning and supply of
materials and equipment

Formation of product
manufacturing
structure

Production dispatching

Calculation
of the financial plan
and product cost
in terms of inventory

Workshop planning

Inventory accounting
at central storehouses
and department
stockrooms

Master production
schedule

Quality management
in production

Inventory of end and
semi-finished products

Based on reference data **calculation and supply** of materials and human resources, product planning and production dispatching are carried out. Integration with third-party systems such as PLM (Windchill, Lotsman, Search), Processes CAD (Techcard) is provided in the directories.

The system offers both centralized (i.e. design and engineering database, roadmap database) and distributed (i.e. orders, counterparties) management of directories in single database.

The following general-system directories are used as basic data for Prisma ADMES calculation base:

Design and Engineering Database Includes data on product bills, shop-to-shop flaw sheet and material consumption rate per item. Supports change notices, mockup design documents	
Brought-in Products Book Integrates data on all brought-in products used at enterprise. Correlates name of brought-in products indicated in supply documents with names from design documents and regulatory documents	
Outfit and Tools Classifier Includes data on process outfit and tools. Used for development, production and accounting of outfit and tools	
Order Directory Includes data on actual orders. Used to monitor an allowable deduction of production costs for a specified order regarding its status (opened, closed, interrupted), validity period and involvement of departments. Supports cost breakdown structure for the order and monitors order execution	
Roadmap Computational Database Comprises of unified process directories for all automated systems of the enterprise and data on timed step-by-step manufacturing roadmaps collected from all Processes CAD systems. Directories are used to specify process availability for implementation of production plan (Roadmap Shortage Report, Shop-to-shop Flaw Sheet Shortage Report, Roadmap Time Control Report)	
Equipment Directory Includes data on equipment in use at enterprise. Used for preparation of roadmaps to manufacture parts and assembly units as well as execution software for computer numeric control (CNC) machines	
End-product Warehouse Includes data on all end products produced by enterprise and correlates supply name with one indicated in the design documents	
Counterparty Directory Includes data on all existing counterparties, the enterprise interacts with, including their bank details	

Management of Approved Product Documentation

Prisma | **ADRS**

(Automated Data Retrieval System for Approved Product Documentation)



Recording and accounting of design documents, change notices, series roadmaps. Preparation of albums (individual sets of design documents). Listing of option parts.



Description of goods is input in Automated Data Retrieval System of Approved Product Documentation only once. Both internal and external clients are recorded in the system. Paper and electronic design documents are recorded in a single data stream.

Data are used by design and engineering database, production management system (soft copy off change notice is transmitted, preparation of accompanying certificate is controlled – last digits of change notice are compared to similar data in roadmap database).

Planning and Supply of Materials and Equipment

Prisma | **Picking**



Automatic preparation, processing and implementation of enterprise demand in accordance with manufacturing plan and laboratory requests.

The system enables to anticipate needs in brought-in products, supply rate of manufacturing plan for brought-in products including the rest at storehouses and stockrooms. The system also allows specifying a purchase amount of brought-in products, tracking the purchase process in automated mode through analysis of the status of requests, bills and invoices.

Basic Functions

Meeting the department demands for inventories

Reserving inventories at central storehouses and department stockrooms

Preparing demands for inventories

Preparing demands for the implementation of research and development

Real-time tracking of purchase progress and timely supply of brought-in products to the enterprise

Preparing planned manufacturing demands for brought-in products

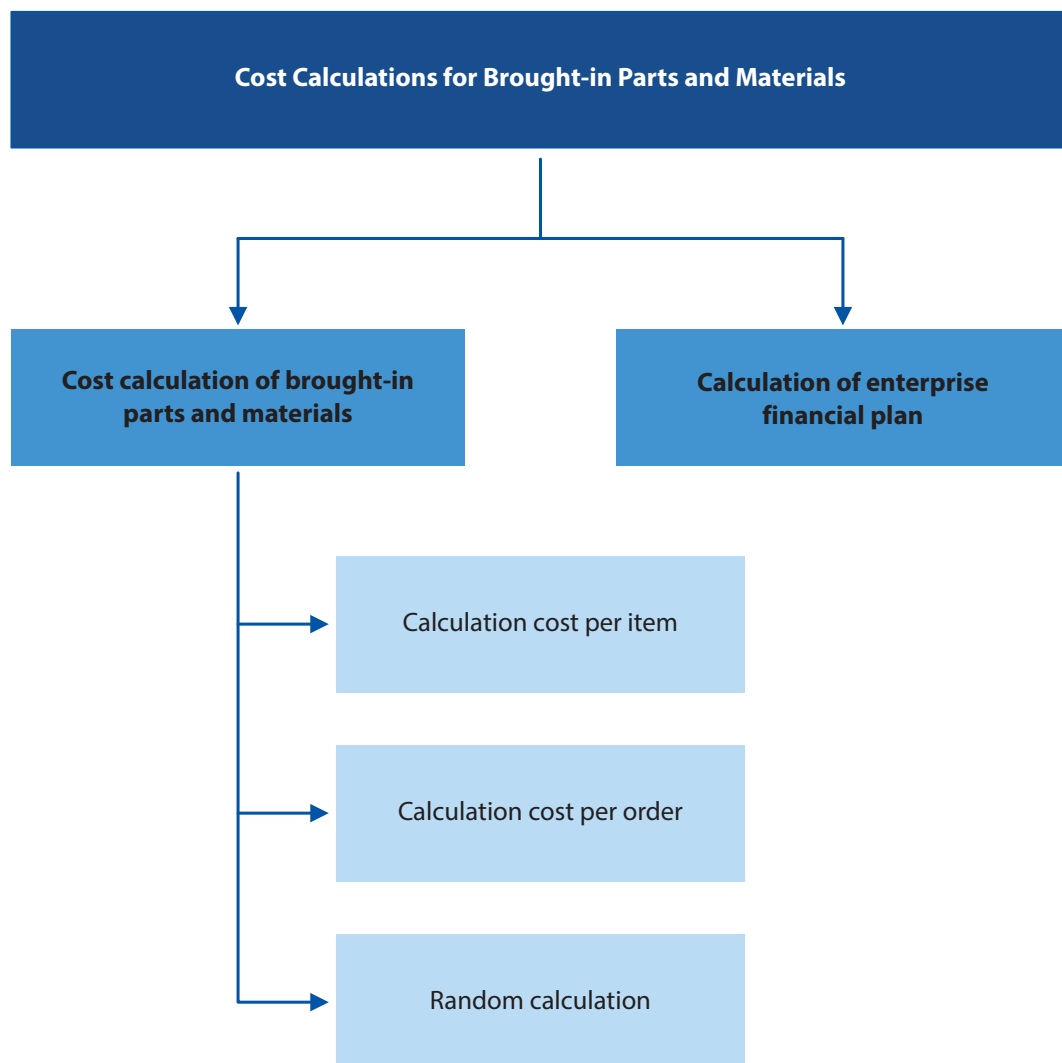
Calculation of cost of brought-in parts and materials and enterprise financial plan to justify the product cost, the price list and other purposes.

The system allows calculating the planned and actual cost per item based on manufacturing plan or an order using price per batch.

There are several algorithms to calculate the cost of purchased products and materials. The calculation algorithms for an item are based on design documents.

The calculation algorithms for an order and manufacturing plan use production bill including process waste.

For inflation adjustment, the cost of brought-in components and materials purchased in previous years is adjusted using deflator indexes.



**Manufacturing plan** for:

- stock-produced items, prototypes, semi-finished products;
- repair, development, re-picking, re-certification;
- fabrication based on analogue product data with random planning horizon.

**Basic
Functions**

Preparing and correcting the dispatch list for the production plant of the enterprise

Monitoring implementation of the manufacturing plan (feedback on execution of plan items). **Production reports** on end products

Informing all interested services about the status of manufacturing plan and the corrections made within the period

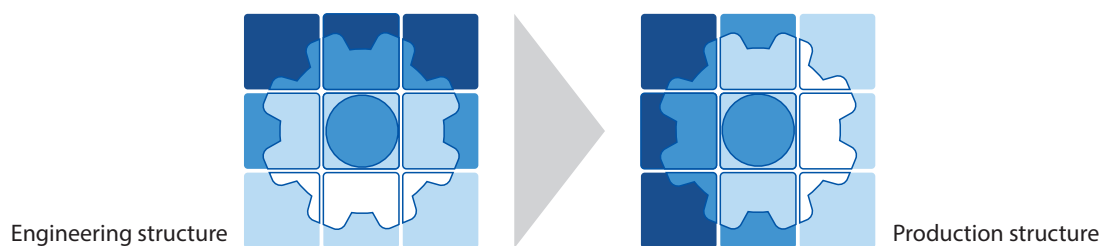
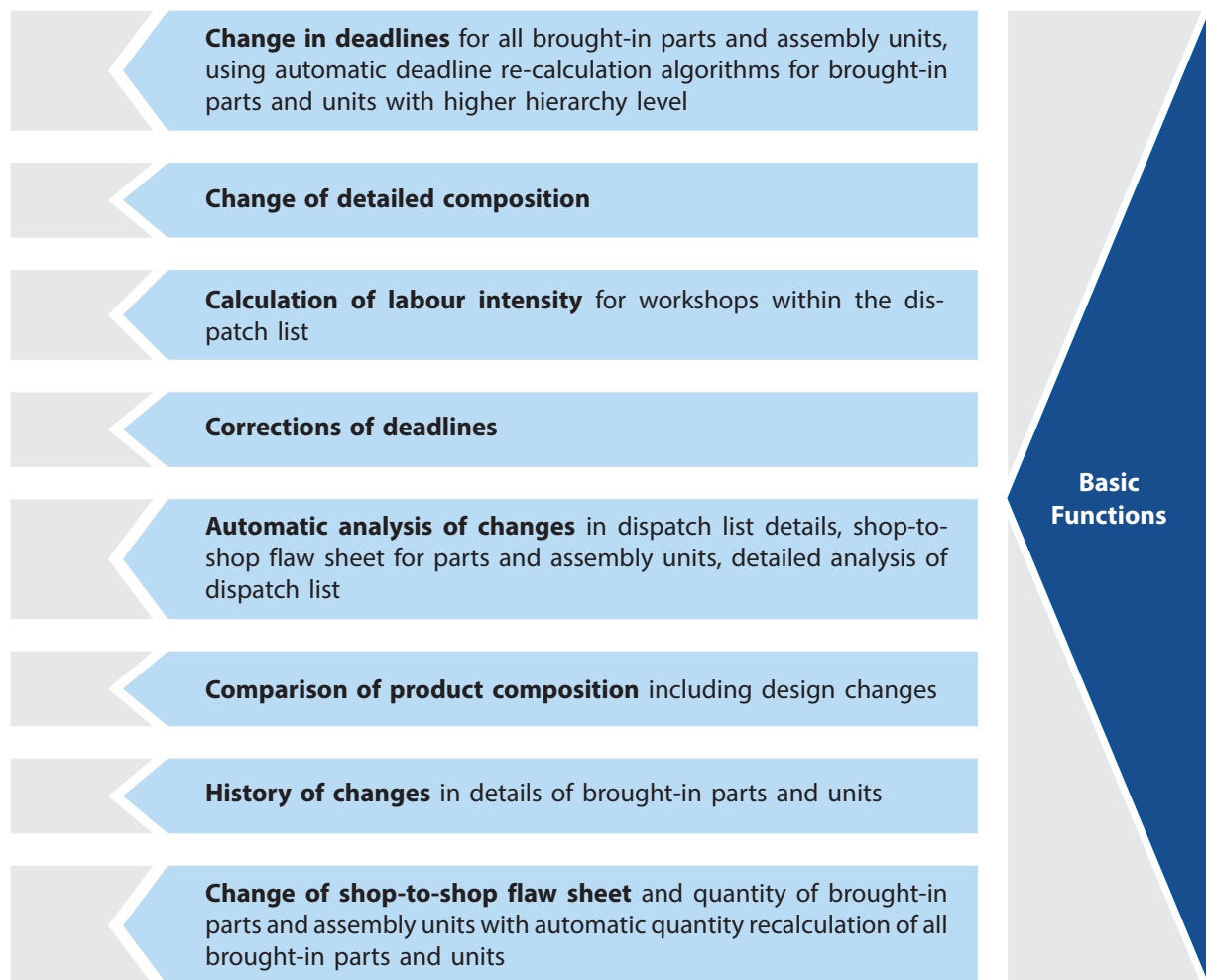
Preparing reference data on orders, DD issues, and product delivery bills

Preparing manufacturing documents based on dispatch list

Dispatch List (DL) is an aggregate of positions from manufacturing plan for any planning horizon. DL specifies range, quantity, order, acceptance type, terms and delivery place for the products to be manufactured for the planned period.

The system offers a capability to prepare a detailed manufacturing plan, i.e. an aggregate of full per-part bills for the selected DL with calculated labour intensity and deadlines for each brought-in part and assembly unit.

Primary processing of calculated matrix for the dispatch list, approval of the dispatch list and automatic inclusion of all brought-in parts and units into plans for appropriate workshops with the following tracking of changes in details and composition of dispatch list, dispatch list matrix correction (if necessary) and automatic correction of workshop plans.





Preparation and scheduling of production plan for parts and assembly units, used in manufacturing chain for items, assembly units and semi-finished products, as well as in manufacturing activities included into production plan with random planning horizon (month, quarter, etc.).

Basic Functions

Preparing a production plan for parts and assembly units

Monitoring the workshop plan, informing all services about the plan status

Workshop plan correction

Preparing production scheduling documents, reports and reference data on performed work and manufactured parts and assembly units in accordance with orders, semi-finished product and part delivery bills, employee efficiency

Calculation of workshop load by work types for the period with monthly breakdown

Calculation of computer numeric control (CNC) machine load for the period with monthly breakdown

Workshop plan is formed automatically and based on manufacturing plan and reference data.

The ability to control quality of produced and received inventory items such as materials, brought-in parts and tools.

The system offers an incoming inspection, the results of which are used to automatically prepare the incoming inspection protocols and the Quality Control Department (QCD) log.

The QCD log contains data on control operations.



Incoming inspection of brought-in products and materials

Parametric incoming inspection with control of laboratory physical and chemical analysis for brought-in products and materials as well as manufacturing of reference materials

Placing the brought-in and made-in products **in quarantine/ scrap**

Preparing incoming inspection protocols

QCD log

Automatic **closing of control operations** in shift task

Support of the product processing procedures including a trial of process tools

**Basic
Functions**



Priority-based distribution of tasks to production plant depending on production time-frame.

Automatic preparation of shift task.

Monitoring and control of manufacturing plan.

Dispatching offers a real-time monitoring of operation-by-operation production process for parts and assembly units, distributing tasks in production areas among executors, preparing work orders.

**Basic
Functions**

Preparing electronic accompanying certificate

Preparing reference data on workload

Automatic **preparation of a shift task**

QCD log

Automatic **preparation of a work order**

Step-by-step processing of accompanying certificates

Preparing multi-order bills

Informing all interested services about the production status of parts and assembly units

Accounting and tracking of inventories such as materials, brought-in parts, tools, economic goods, etc. at enterprise's central storehouses and department stockrooms.

Picking process for assembly units to be assembled.



Preparing receipt/payment accounting transactions and documents

Inventory accounting at enterprise's central storehouses and department stockrooms

Inventory picking for electronic accompanying certificates, individual dispatch lists and parts and assembly units

Inventory reservation for dispatch list

Inventory taking using inventory bar-codes

Accounting tools and process tools at tool storage rooms by their storage places and logging data on their distribution to workers

Computerized preparation of product delivery bills

**Basic
Functions**



Preparation of bills for delivery of end products, including semi-finished products and relevant accounting documents.

End products are accounted by means of electronic bills on the plan position and accounting documents.

Rage is type-divided into: delivery of end products, delivery of prototypes, delivery of repaired items, delivery of work pieces and parts, delivery of inventories to storage, delivery of semi-finished products.

Price for semi-finished products is calculated by economic planning department and is stored in system for reporting period.

There are different symbols for the end products in the system such as graphical and delivery symbols with keeping connection between them.

Basic Functions

Preparing and correcting bills

Committing bills to economic planning department for acceptance

Possibility to make/withdraw an acceptance from bills

Accounting of semi-finished and end products; preparation of relevant **accounting documents**

Viewing/printing bills

Closing the plan position after the acceptance of bills by economic planning department

Management of planning and production of process tools. Data processing when ordering, planning and producing process tools at the workshops. Enables to get updates about production at the Chief Process Engineer Department.

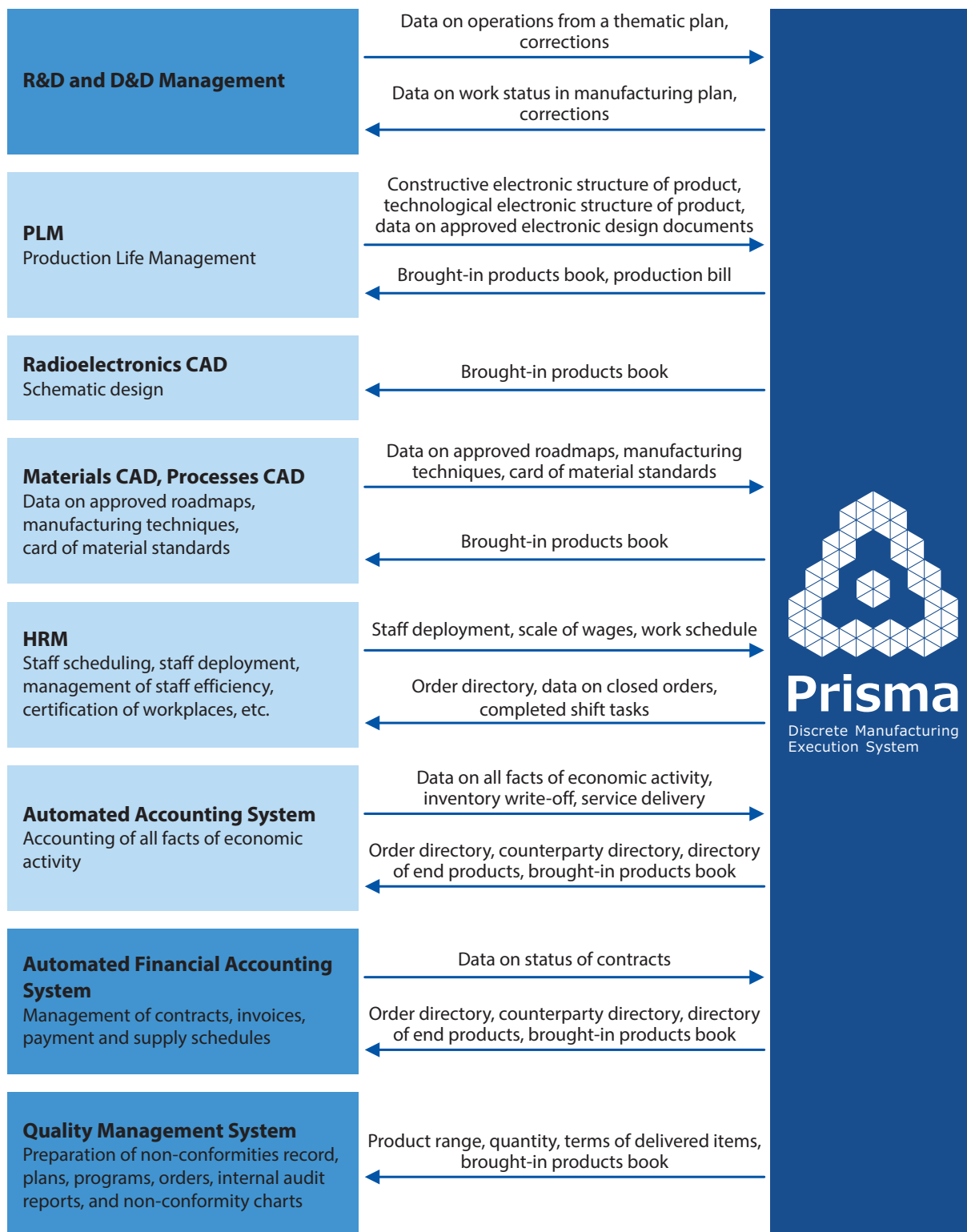
The system provides connection between a primary production plan for range and launch/release terms of a product.

Data from the system can be seen in primary production planning and dispatching modules.



Prisma ADMES | General Chart of Interaction

with Other Components of Enterprise Integrated Information System

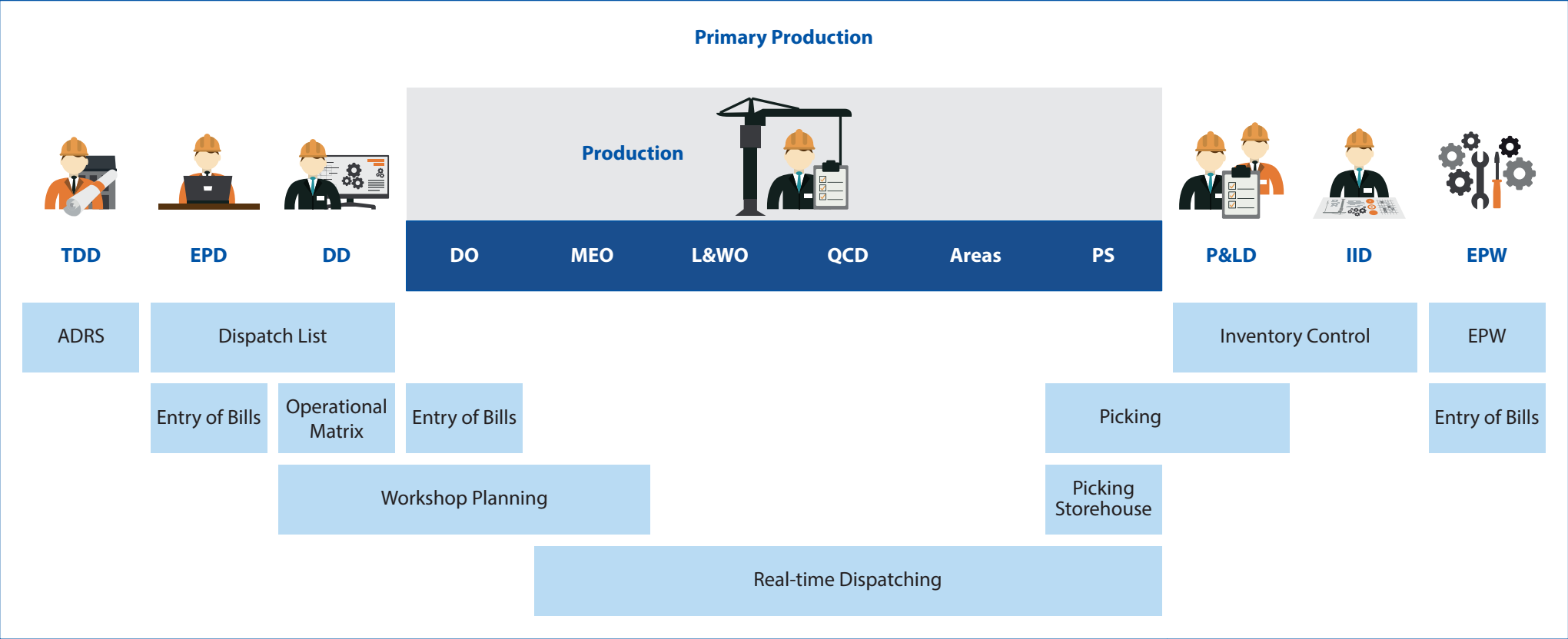


Systems developed by VNIIA.
Possible integration with traditional and third-party systems

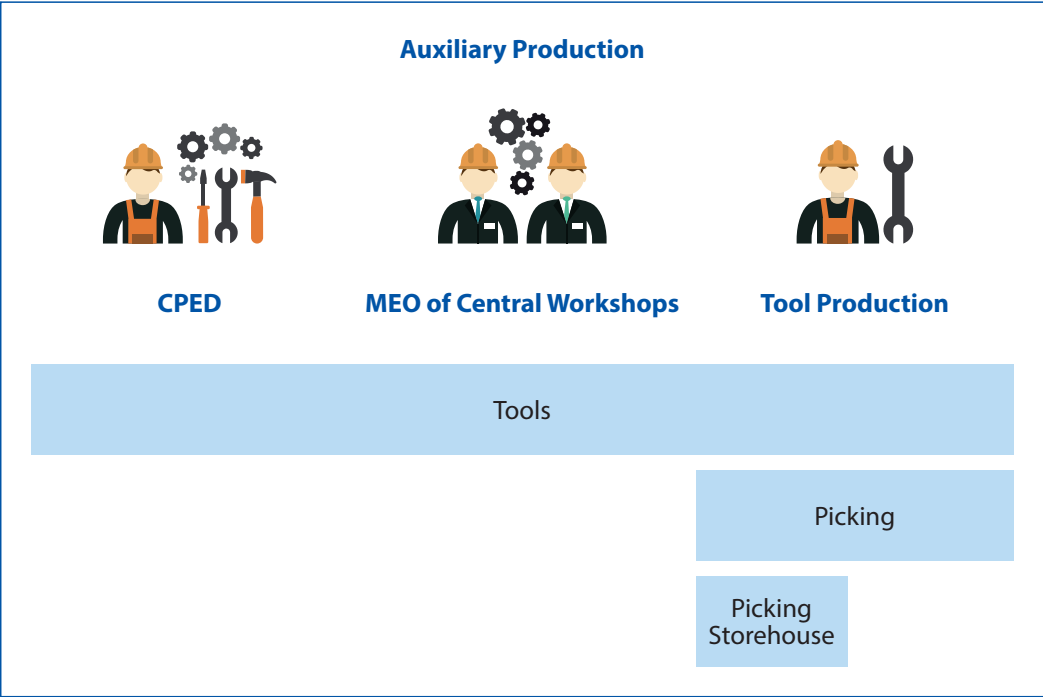
Third-party systems

Prisma ADMES | Institutional Framework

It is necessary to have the following frame of participants in production management for correct and effective operation of Prisma ADMES



- TDD** - Technical Documentation Department
- EPD** - Economic Planning Department
- DD** - Dispatching Department
- DO** - Workshop Dispatching Office
- MEO** - Workshop Manufacturing Engineering Office
- LWO** - Workshop Labor and Wages Office
- LWD** - Labor and Wages Department
- QCD** - Quality Control Department
- Areas** - foremen, workers, progressmen
- PS** - Workshop Picking Storehouse
- P&LD** - Procurement and Logistics Department including central storehouses
- IID** - Incoming Inspection Department
- EPW** - Enterprise's End-product Warehouse
- CPED** - Chief Process Engineering Department



Prisma ADMES | Integration with other systems

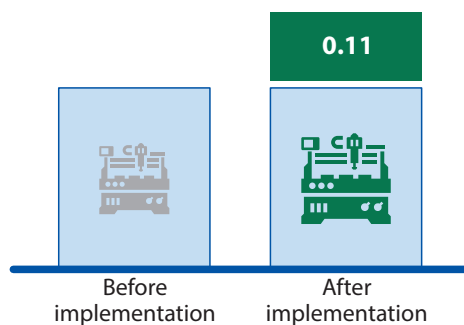
Due to available data export/import tools, Prisma ADMES can provide a full integration interface with any software, so it functions for integration of enterprise information space.

Data exchange between systems is carried out with the help of staging tables, XML files, and API functions. The systems interface with each other using attributes described in a functional chart of Prisma ADMES in the integrated information system of the enterprise.

Prisma ADMES | Results of Implementation at VNIIA

Higher efficiency of CNC machines due to:

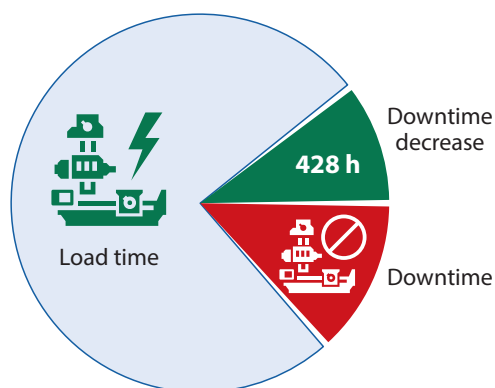
- Actual load situation** and regularity of pace of equipment operation;
- Control of labor discipline of staff** operating machines;
- Fixing machine downtime**, downtime classification and its fast elimination.



Equipment efficiency rises by 0.11
(without setup time).

Lower machine downtime due to:

- Precise planning** of machine capacity according to the plans;
- Specifying the weak points** of production;
- Optimization of equipment capacity.**



Machine downtime since September 2016 till January 2017 using Prisma ADMES (commercial operation) **decreased in 428 hours per month** which is 35 hours per month (4 shifts) for equipment unit.

Optimization of inventories due to:

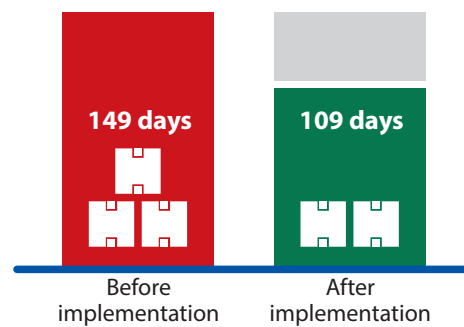


Distribution of resource demands;

Preparation of inventories just in time;

Reduction of in-process queue time.

Resource turnover reduced from 149 to 109 days.



Potential rise of order book due to:



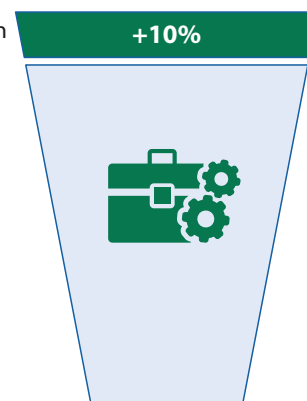
Power optimization of production cluster;

Understanding of possible production load;

Production re-prioritization.

Potential rise of order book at invariable equipment fleet is up to 10%.

After implementation



Prisma ADMES | Specifications

Prisma ADMES is developed on the basis of client-server technologies.

Oracle is used as database management system.

Client workstations are designed to work with Borland Delphi 2006, using Developer Express v10, FastReport 3.19, ODAC 5.55.1.24.

In order to work with single database, the enterprise must develop a local computer network for all departments involved into the production management.

Workstation

Processor	Pentium 4 (or better)
RAM	1Gb (or more)
Net Adapter	100 Mbit (or more)
Monitor	resolution 1024x768 minimum (or more)
Input Device	keyboard, mouse
Ports	USB
Printer	300 dpi (or more) laser printer
Operating System	MS Windows XP (or better)



Database Server

Data Management System	Oracle 10g EE/SE/XE, 11g EE/SE/XE, 12c, 19c
Hardware	Oracle Corporation requirements for the version of data management system



File Server

Software characteristics of file server should not be worse than workstation characteristics



Prisma ADMES | Rightholder

Dukhov Automatics Research Institute (VNIIA), Federal State Unitary Enterprise.

VNIIA is included in the unified register of the Ministry of Communications of the Russian Federation as a developer of domestic software (by order No.426 of the Ministry of Communications of the Russian Federation dated 6 September 2016).

Prisma ADMES | Implementation

Following enterprises currently use Prisma ADMES as a tool to manage manufacturing and material support:



ROSATOM

**Dukhov Automatics Research Institute (VNIIA),
Federal State Unitary Enterprise**
(Moscow)

**Zababakhin Technical Physics Research Institute
(Russian Federal Nuclear Centre),
Federal State Unitary Enterprise**
(Snezhinsk)

**Mayak Production Association,
Federal State Unitary Enterprise**
(Ozyorsk)

**N.A. Dollezhal Research and Development Institute
of Power Engineering,
Joint Stock Company**
(Moscow)

**Ural Electromechanical Plant,
Joint Stock Company**
(Yekaterinburg)

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