



The Space Congress® Proceedings

1996 (33rd) America's Space Program -What's Ahead?

Apr 23rd, 2:00 PM - 5:00 PM

Paper Session I-A - A Launch Vehicle and Facilities Optimized Operational Management: A Key To The Efficiency For A Space Transportation Company

Roger Solari

Director of Operations Delegate, Head of Arianespace Kourou (French Guiana)

Follow this and additional works at: <https://commons.erau.edu/space-congress-proceedings>

Scholarly Commons Citation

Solari, Roger, "Paper Session I-A - A Launch Vehicle and Facilities Optimized Operational Management: A Key To The Efficiency For A Space Transportation Company" (1996). *The Space Congress® Proceedings*. 6.

<https://commons.erau.edu/space-congress-proceedings/proceedings-1996-33rd/april-23-1996/6>

This Event is brought to you for free and open access by the Conferences at Scholarly Commons. It has been accepted for inclusion in The Space Congress® Proceedings by an authorized administrator of Scholarly Commons. For more information, please contact commons@erau.edu.

EMBRY-RIDDLE
Aeronautical University™
SCHOLARLY COMMONS

A LAUNCH VEHICLE AND FACILITIES OPTIMIZED OPERATIONAL MANAGEMENT : A KEY TO THE EFFICIENCY FOR A SPACE TRANSPORTATION COMPANY

**Presented by Roger SOLARI Director of Operations Delegate
Head of ARIANESPACE KOUROU (French Guiana)**

When the ARIANE Programme was decided, it took knowledge of the EUROPA launch Vehicle development experience.

What was wrong in the first Europe attempt to built a high performance launch vehicle in order to get it's own autonomy to space access? Certainly not the technology nor the technical skillfulness. What was in fact the main source of all the difficulties encountered with EUROPA was a lack of management, a lack of coordination, a lack of leadership in all the programme aspects.

The lesson was well understood but when the ARIANE Programme was decided, a few people would have bet a penny on the success issue of this adventure. Nevertheless, Europe gained finally it's own capacity to space access and one of the strongest trump of this achievement relied on the existence of management specifications in all the programme aspects under a single but controlled management leadership.

This same management process is being applied in the operational phase

In it's three missions, ARIANESPACE leads the whole field of activities belonging to a space transport industrial and commercial company :

- the sale of the launch service on the open commercial international market;
- the financing and the direction of the launch vehicles production;
- the execution of the launch service on it's launch facilities.

To sustain a successful determinate commercial strategy, a space transportation company must rely on a particularly efficient operational tool, able to match a permanent technical challenge to face a high launch rate without any lowerage in rigor and safety. Fruit of 15 years of experience, the ARIANESPACE Directorate of Operations provides in Kourou (French Guiana) to the company a well adapted operational launch production unit.

To reach such an objective in an organization mixing a lot of different European technical cultures, the action must be based first, upon well proved methods and recognized rules of management, then upon strong leading criterias such as Continuity (to maintain a high launch rate process), Productivity (launch costs reduction, . . .), Reactivity (fast discrepancies fixtures, . ..). Flexibility (appropriate reaction to any technical or operational critical situation), finally everything must be achieved under a strong quality process where rigor and safety do not suffer any waiver.

Continuity and productivity come first in line as far as to fulfill the work load imposed by the commercial competition we need to sustain a high launch rate at the minimum induced cost.

To reach this objective, we have to optimized :

- the human resources
- the operations on both the on board and the ground under a permanent safety constraints pressure.

About the human resources, a good result has been achieved by way of a typical industrial organization covering the on board and the ground activities. It is based upon :

- a large tasks delegation process to the industrials
- a fully integrated operational plan with standard procedures written under a unique set of management specification able to cope with all the technical cultures of the ARIANE community.

The feasibility of such an optimization relies on the existence of a fully integrated operations plan placed under the single management of a unique operations production manager. We will talk about this topic latter.

To improve the optimization of the launch facilities ground activities, the industrial organization has been pushed farther in the integration process.

In the way toward for the best efficiency during the transition phase where both ARIANE 4 and ARIANE 5 are going to be operated, the ground industrials have been gathered in three main groups dedicated to similar activities under a strong objective of synergy for both the launch complex number 2 an launch complex number 3 respectively dedicated to ARIANE 4 and ARIANE 5 (see appendix 1).

The activities have been splited in three main branches assigned to three industrials groups each one being managed by one industrial of the group with a single contractual interface with ARIANESPACE.

The first group has been dedicated to mechanical and fluids activities, the second to Command Control activities and the third to air conditioning and energy distribution systems.

How to produce a launch in a high launch rate process with rigor, safety and quality ? Our answer relies on a strong operations management tool based upon (see appendix 3) a single ARIANESPACE operational production manager for all the activities, exercising a full authority : to planify, to coordinate, to fix priorities, to use the resources, and having at his disposal :

- A permanent planification tool
<< real time
- A fully integrated operational plan mixing launch vehicles operations, ground facilities activities (refurbishment, maintenance, modifications) under safety constraints and quality requirements (see appendix 2)
- A coordination team composed of a quarter deck engineer in charge of the execution of the daily activities accordingly with the integrated operations plan and a safety officer to guaranty human and assets safety
- All the resources (human, hardware and software)

In term of planification a strong effort has been achieved bases upon our experience. The result constitutes one of our best asset in term of enginery (launch vehicle campaign duration achieved in 26 working days, with the execution of around 1000 typical operations and a staff of less than 100 people).

A rough description of the ARIANESPACE approach in this affair is presented in appendix 4.

The effort on the resources optimization within the frame of a fully integrated operations plan was a great source of economy (- 20 % in operations cost, - 20 % in launch vehicle campaign duration).

In the same way the number of working days required for launch campaign activities has been optimized and the delta in between two launches has been brought down to three weeks at the minimum.

Beside the operations preparation process of a launch vehicle itself, it is essential to guaranty the technical configuration of the launch vehicle being prepared and to certify that the operational process has been achieved under the quality rules of the society.

In this way an ARIANESPACE launch team is composed of three entities :

- 1) **An operational component part of the ARIANESPACE Directorate of Operations**
It is the leading structure in charge of the launch preparation process.
- **A Technical Authority Component part of the ARIANESPACE Industrial Directorate**
responsible for the launch vehicle technical specifications.
- **A quality Component part of the ARIANESPACE Quality Directorate**

Such a close integrated structure on the terrain is a source of consistence and efficiency.

For the time being the 15 years of ARIANE operations experience brought us to the conclusion that a management responsibility within the same hands in a multiple organizations structure is the key factor to set up a low cost, reactive an flexible launch tool.

For sure, perfection is not yet fully achieved !

The perspective of the transitory phase with both ARIANE 4 an 5 to be operated at the same time within the same management, operational, industrial and technical structures will keep the same philosophy with a good opportunity to improve the efficiency of the system.



INDUSTRIAL ORGANIZATION : LAUNCH FACILITIES

3 MAIN GROUPS (1 INDUSTRIAL IN CHARGE)
EACH GROUP

FLUID/MECA

- CEGELEC
- MAN
- PEYRANI
- ALSG

CONTROL/CD

- CLEMESSY
- ETCA
- GTD
- THOM. CSF

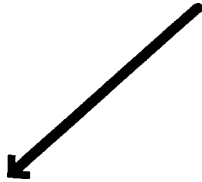
ENERGY/AIR COND

- DELATTRE/LEVIVIER
- FABRICOM
- CLEMESSY

ARIANESPACE

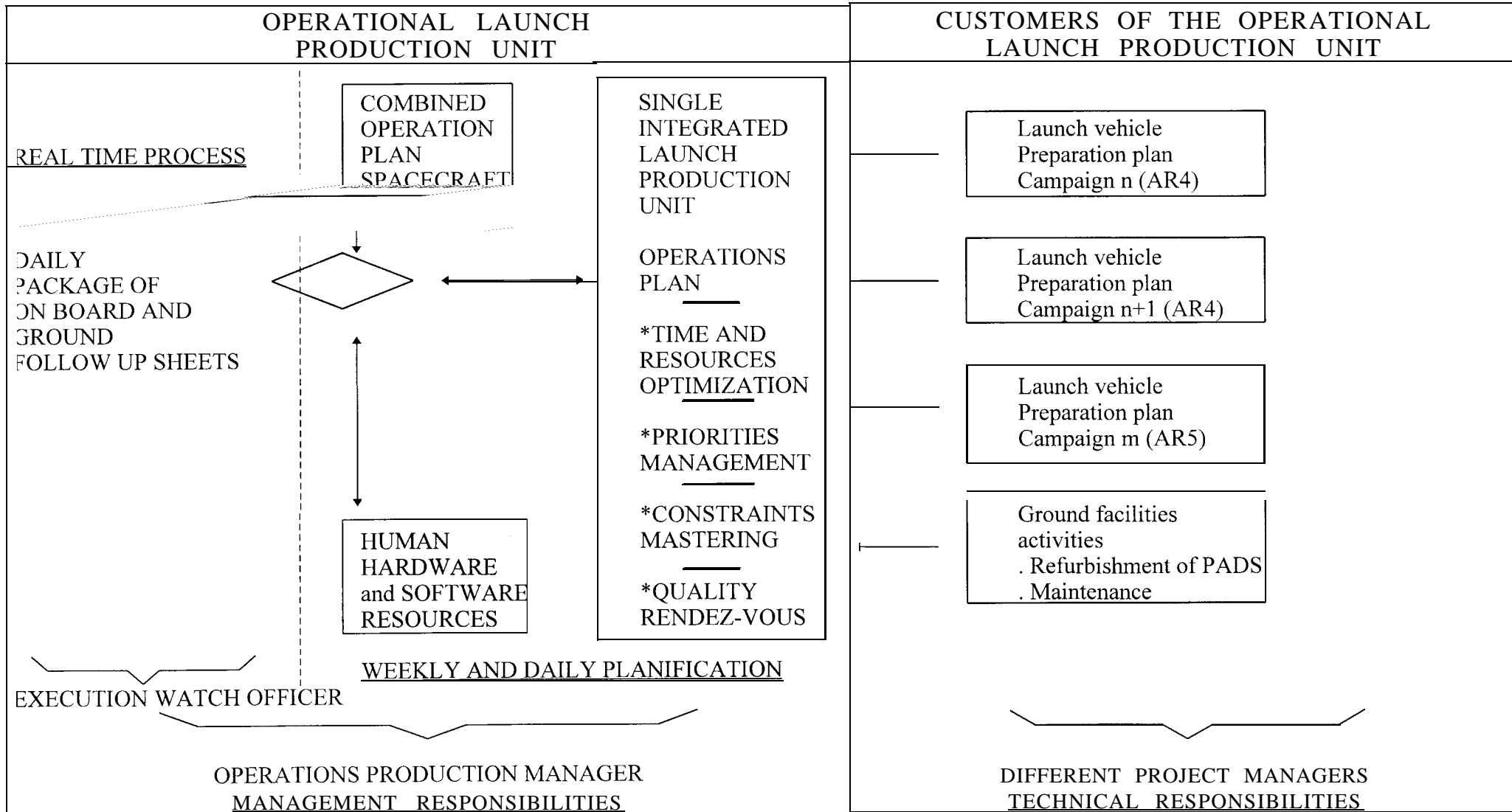
- ELA2
- ELA3

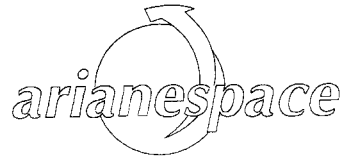
C.S. G





LAUNCH PRODUCTION PLANIFICATION AND EXECUTION PROCESS





OPS MANAGEMENT PROCESS

OPS PRODUCTION MANAGER

Full authority :

- TO PLANIFY
- TO COORDINATE
- TO FIX PRIORITIES
- TO USE HUMAN + TECH RESSOURCES

— AN EFFICIENT PLANIFICATION TOOL (REAL TIME)

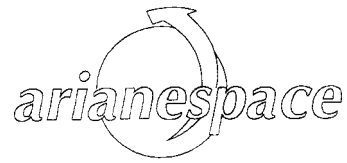
— A FULLY INTEGRATED OPS PLAN
 with integrated
 . quality process
 . safety constraints

— L/V OPS
 GROUND FACILITIES OPS
 MAINTENANCE
 MODIFICATIONS

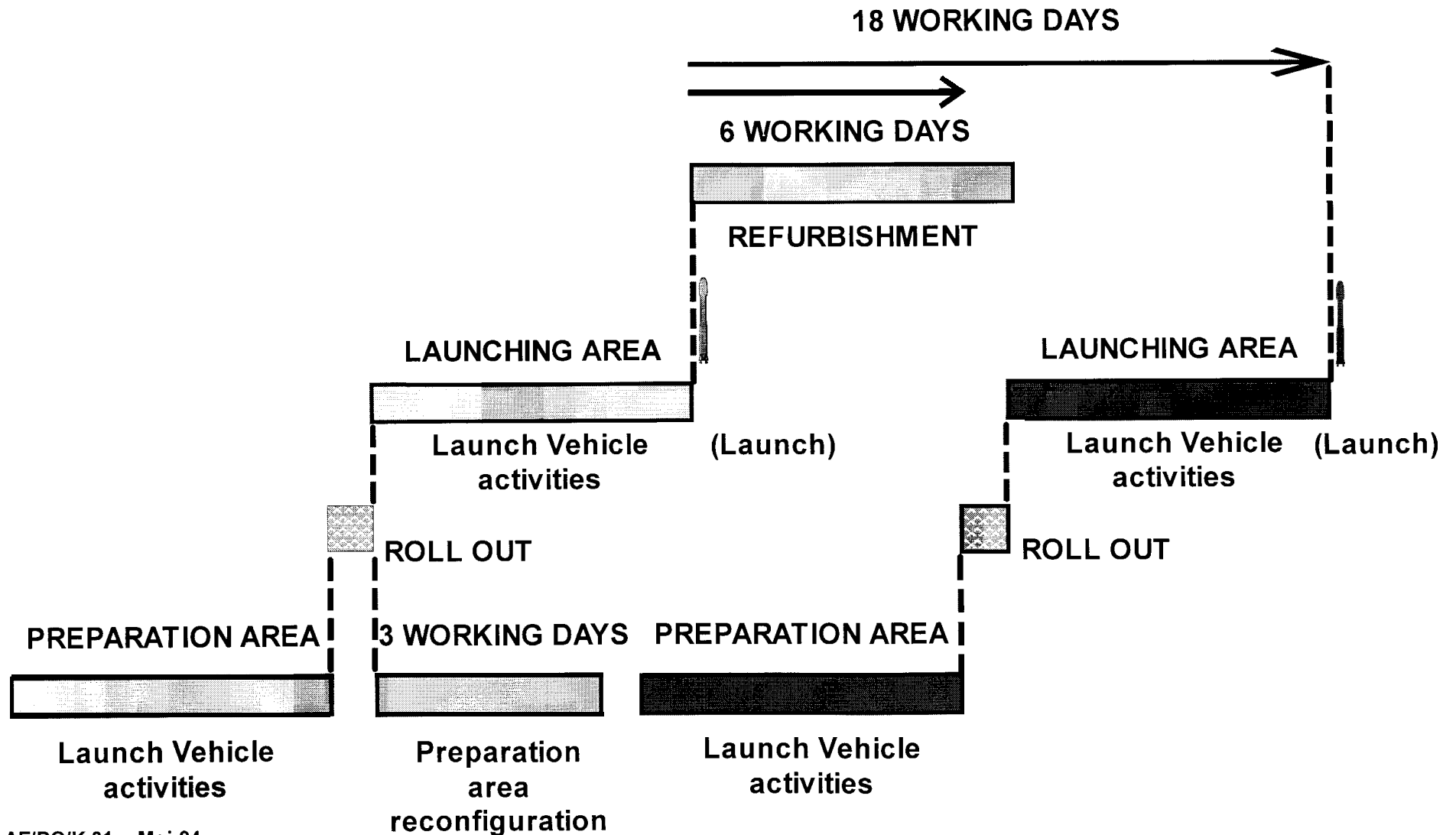
— A COORDINATION TEAM
 . QUARTER DECK ENGINER — OPS EXECUTION
 . GROUND SAFETY OFFICER

— ALL HUMAN AND TECH RESOURCES

1-22



ELA 2 STANDARD LAUNCH VEHICLE CAMPAIGN CYCLE



APPENDIX 4

PLANIFICATION TOOL

(Synthesis from a previous Arianespace presentation by

MM TROTIN and BARTOLOMEY intitled < ARIANE Launcher real-time operational planning >

I. INTRODUCTION

A launch campaign involves management of the following parameters :

- between 800 and 1000 operations in the space of six weeks, with a basic time unit of 30 minutes,
- 100 different qualification procedures for human resources,
- 35 unique or limited material resources (gantries, special tools, etc.),
- 10 exclusive resources,
- 100 different geographical sites.

One launch campaign is never identical with another. A standard operations plan is in fact no more than a framework, in which the operations specific to a particular launch are inserted.

These specific operations can be estimated at between 10 and 30% of the total number of standard operations.

II. ORIGIN OF THE NEED

Arianespace was confronted with the problem of operational planning as from the start of its activities, and quickly reached the conclusion that conventional manual planning (< ruler, pencil and eraser >) was inadequate for meeting the identified need for resources management.

Arianespace consequently bought a commercial computerized project management system.

The limitations of this type of system soon became apparent :

- The basic time unit required for management of launch activities (30 minutes) leads to prohibitive computations times. in the order of several hours to modify an existing time schedule.
- The system places activities in order, but subdivides them into a number of segments, according to schedule-related or other imposed constraints.
- Certain resources cannot be managed correctly. In particular, commercial software products are not capable of managing exclusive resources (management of a resource and its opposite).
- Notions of < just in time > management are not taken into account.
- Conventional systems can handle < at earliest > planning, but not < at latest > planning. In no case is it possible to achieve simultaneous < at earliest > and < at latest > management with conventional software products.

These examples demonstrate :

- the inadequacy of conventional P. E.R.T. methods,
- and the need for programs tailored to solve specific problems.

III. ARIANESPACE METHODS AND APPROACH

Planning concept

3.1 General principles

It is an error to attempt to adapt the process to an existing planning tool. On the contrary, an appropriate tool must be adapted or created to meet the need.

3.2 Planning objectives

The planning function must ensure :

- Compliance with time schedule objectives (critical path in particular).
- Assignment, management and optimization of critical resources.
- Identification of the consequences of unscheduled operations and program changes.
- Simulation of these random factors, and replanning of operations for the activity centers concerned.
- Maximum reduction of operating costs.

IV. UNDER THE PREVIOUS PRINCIPLES A PLANNING TOOL AND ITS UTILIZATION PROCESS HAS BEEN DEFINED

The main utilization functions are as follow :

- A tool developed from the concepts described above is used to plan the 3 main phases of each launch campaign :
 - preparation of standard operations plans,
 - preparation of specific operations plans,
 - real-time monitoring (operational planning).
- The computation time for a time schedule involving 700 to 800 operations associated with 200 different resources, must not exceed between 2 and 3 minutes, and screen display of a simulation should take less than 20 seconds.
- The speed with which a simulation can be obtained, combined with the assurance that all constraints described in the data base have been taken into account, means that reliable hypotheses providing a management aid for operational activities, are available in real time.

Histograms can be obtained showing :

- smoothing of human resources and consequent maximum reduction of personnel workload variations,

- assessment of the load rate for resources effectively used,
- optimization of the resources utilization factor,
- time schedule optimization, with reductions in total schedule length and the number of non-standard hours worked.

V. REAL-TIME OPERATIONAL PLANNING

This phase corresponds to real-time monitoring of the actual launch campaign.

This means execution of real-time simulations (with results available in no more than a few minutes), in order to compare different scenarios for the utilization of available resources, and to take valid decisions.

with the use of menus, integration of additional operations is achieved in no more than the time required to enter data and recompute the time schedule,

this replanning function represents an optimized solution, ensuring optimum utilization of available resources while meeting existing constraints,

the computer tool can be used on a day-to-day basis, to reoptimise the time schedule for the following days, and draft the instructions required for continuation of operational activities the next morning.