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The 8th International Workshop on Organisational Semiotics

Application of Organisational Semiotics to Project Management

and Risks Management in Complex Projects

23 – 24 June 2005, Toulouse, France

The study of space gives rise to very complex projects calling for contributions from many varied communities of knowledge and practical expertise. These different cultures and their specialised languages define separate ***information fields*** that generate problems for communication and collaboration, even during the development of technical objects, but especially in the phases of project definition, systems requirements engineering and design.

These technical object are not given, *a priori:* they have never been realised before. On the contrary, they are progressively built up by negotiating the meaning of terminologies, formulas, drawing and other representations of artefacts intended to satisfy the many agreed requirements, mechanical, electrical thermal etc. In other words - at least before their construction - these objects have no concrete existence but are semiotic objects; and even when built, their projected behaviour in distant corners of space will be known to us only as semiotic constructs.

Conference Information:

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Organisational semiotics offers a framework for understanding the processes that this project work entails, in particular the interaction between individuals, between groups, within society, as well as between human and technology.

Holding the 2005 OS Workshop in Toulouse - the French capital of aeronautics and space presents us with the opportunity to test ideas from Organisational Semiotics against the problems generated by very complex projects on the frontiers of engineering where complexity and risk are major factors. CNES (Centre National d'Etudes Spatiales), through its Technical Competency Centre in Management (CCT MAN), has provided two excellent, illustrative cases in space exploration. Of course many of these problems are also encountered in other fields.

To stimulate the contribution of OS ideas, CNES has emphasised two important issues to explore.

- The management of complex highly innovative, multidisciplinary projects during their early volatile phases.

- The management of risks faced by such projects that may run far into the future possibly beyond human intervention.

There are many different issues associated with these to which OS can contribute.

However other applications of organisational semiotics to philosophical, social, and technical issues will also be considered. **Therefore paper submission is not restricted to the following topics**:

Topics

A: Management of Projects in their Early Phases

A very large project in its formative stages tends to resist the application of established management tools and techniques that are better suited to later stages when the product is well understood, its manner of production established and the work - although complex - is subject to a stable plan of action.

Between stating the broad objectives and defining precisely the means of satisfying them with a clear plan of action, the project requires a rapidly growing and changing community that must also develop trusting relationships even while working on designs and plans that necessarily introduce many conflicting creative ideas.

You are invited to show how you could apply OS to the management of these early, turbulent processes. Take one or two issues and show how OS can, for example,

- contribute to our understanding of the problems,
- provide methods of observation or analysis,
- improve communication among participants
- supply problem-solving techniques or
- support the application of information and communication technologies (ICT).

There are many topics you might consider; the following, far-from-exhaustive list of suggestions, are illustrative.

Maintaining and adjusting the balance between informal and formal ways of working.

When formality, including IT support, is introduced, the flexibility to cope with frequent changes of requirements should not be lost.

The broad statement of objectives must be translated into precise definitions of what must be done and how - so the creation of meaning plays a key role in these stages.

Solutions to such problems as these call upon many disciplines, and this raises problems of mutual understanding.

Innovation may entail using new terminology. To what extent? How do project teams achieve this and negotiate agreement?

Necessarily, some terminology will be rather vague at the project's beginning and much of the effort will be devoted to making it precise enough to prescribe successful action. How can progress on this be facilitated, tested and retained?

At every stage many options will be open, especially at the beginning. Alternative ideas will compete and this many generate personal rivalries. Can a wealth of creative thinking be encouraged without inhibiting the growth of trust and the formation of good relationships?

While arriving at solutions to the numerous problems encountered the process may display various pathologies (for example: "group think" is one of them, when an idea gains a momentum it does not deserve because the group-appears to have reached a consensus that no one is willing to criticise).

Even when a good solution has been negotiated, unexpected events, financial difficulties etc may call for a change of track. Such volatility cannot be avoided.

Does OS offer any strategies that might be tested by using experience in current projects for observation, investigation or experiment?

B: Management of risks

Risk is related to the degree of knowledge available about the domain of activity. Can OS contribute to our understanding of this problem? Consider, for example, the taxonomy of knowledge zones suggested in the Rosetta briefing and Peirce's division of reasoning into deductive, inductive and abductive for different kinds of knowledge.

Although the early planning, design and development stages provided the greatest scope for risk-management decisions, options are not closed even after the launch of a spacecraft. What can be done to enlarge the scope for risk-management?

The flight of a craft has many phases with particular associated functions and so risks change (the trajectory may include periods in orbit around planets and moons). How might the semiotics aspects of these phases relate to the style of risk management (c.f. ships and aircrafts)?

The principle benefits from a project (especially one-off projects such as Rosetta) emerge only when the spacecraft completes its mission and the laboratories begin years of work to analyse the data returned to Earth. Should risk management decisions take account of the values of these data-streams?

As a spacecraft may never reach its destination, what other values can such projects yield? How can they be identified and assessed, and used in making risk-management decisions?

How soon should a project's values be assessed and how frequently re-assessed during its life? And by whom?

A long term project lasting from its proposal to completion (including data exploitation) will engage a changing population of hundreds of scientists and engineers. A good organisational memory is essential and it can only be formal and documented in part.

Documentation and computer records will use terms with no guarantee that, over three decades, they will continue to represent the same concepts.

Terminology at each point of time will be understood in the context of the current state of knowledge and the associated informal culture that provides its interpretation. How can we monitor relevant changes in knowledge and cultural context over 30 years and how should we react to them?

Even a failed project should yield skills and knowledge, much of it informal: how can these be registered, evaluated and redeployed effectively?

Informal systems play vital roles, especially during the project's turbulent early phases. How can they be made effective? How can their practices and achievements (such as creating new negotiated meanings) be anchored into the organisational memory?

C: Free applications of organisational semiotics

This heading includes free applications of organisational semiotics and relevant issues on philosophical, social, and technical using semiotics concepts and methods from an organisational perspective.

Remarks: To give examples of the concrete reality of this kind of work CNES, through senior engineers, has given us two briefing documents of the IASI and

Rosetta projects with leads to more details on associated web sites. (***These briefings are presented in the annex below***)

Submission

We invite **submissions of extended abstracts** (4 pages) for review. After the workshop, based upon the decision of programme committee, authors of accepted abstracts will be asked to submit a full paper to be included in a future book edited by the conference chairs.

We strongly recommend **poster presentations** even when a paper is submitted as well. In the case of submission of a poster presentation only, a **poster proposal** is to consist of an extended abstract of 2 pages that emphasizes the research problem and the methods being used.

When presented ample space will be provided for posters, which can be on display for the whole period of the workshop. Posters will suit not only OS Workshop participants but also scientists and engineers engaged in risk- or project-management in CNES and other organisations.

Submission should be sent to the following address : ***charrel@univ-tlse2.fr***.

Location

The workshop will be held in the "Maison de la Recherche" of the University of Toulouse-le-Mirail, Toulouse, France.

Important dates:

Extended abstract submission: April 15, 2005 in MSWord or PDF
Notification of acceptance: May 10, 2005
Camera ready version: June 5, 2005, in Word
Workshop: June 23-24, 2005

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Annex

CNES, through senior engineers, has provided thereafter two briefing documents of the IASI and Rosetta projects with leads to more details on associated web sites.

Case-1- IASI Project

AN EXAMPLE OF A PROJECT MANAGEMENT CASE: THE IASI PROJECT

1. PROJECT MANAGEMENT IN SPACE ACTIVITY: AN INTRODUCTION

A project ... is to go from designing to building...

In order to reach this goal, we need competencies and means in order to accomplish the different steps of the process, included the ability to co-ordinate these steps. Information (in the different forms of data/information/knowledge) and their processing are the principal elements of this process. The particular attention to the way the project uses its informational resources in order to achieve a success, could be a definition of Project Management activity.

A more classical definition of Project Management is the controlling of the evolution of all the aspects of the project, including Time, Resources and Risks. But this definition implies that semiotic/informational devices (such as relevant indicators, plans...) are available in order to:

- anticipate planned events
- permanently adjust means and constraints
- start actions to preserve sufficient margins
- communicate (inside and outside the project) in order to manage conflicts, and motivate the teams.

In the case of large projects (such as space projects) the explicit (software) component dedicated to information processing is only a part of the information system (as is? the organisation) since the organisation does not reduce to it. However in this case the description of the information system as a whole is difficult because we are faced by the heterogeneity of the organisation. Prime contractors, manufacturers, customers etc. constitute different aspects of this organisation. It is not therefore easy to guarantee its efficiency: it is the purpose of the project management activity.

2. THE IASI PROJECT

IASI (Infrared Atmospheric Sounding Interferometer) is a significant technological and scientific step forward that will provide meteorologists with atmospheric emission spectra to derive temperature and humidity profiles with a vertical resolution of 1 kilometer and accuracies of 1 kelvin and 10% respectively.

The first flight model is scheduled for launch in 2006 onboard the METOP series of European meteorological polar-orbiting satellites.

CNES is leading the IASI program in association with EUMETSAT (Europe's Meteorological Satellite Organisation)
CNES has technical oversight responsibility for the instruments up to the end of in-orbit commissioning.
It will develop the Data Processing Software which will be implemented in the EUMETSAT Polar System ground segment and will develop and operate a Technical Expertise Center.
EUMETSAT is responsible for operating the instrument and the associated data processing, archiving and distribution to users.

In 1998, CNES and Eumetsat awarded Alcatel Space with the development and production of three IASI instruments which will be carried on the Metop satellites.

(All the information about the IASI project can be found on the CNES site: www.cnes.fr in the "*CNES programmes*" entry, then "*Sustainable development*" entry*, IASI* sub-entry)

The cooperation between CNES and EUMETSAT started in 1997 and the final version of the Cooperation Agreement was signed in 2001.

In the agreement reached CNES is responsible for developing and providing 3 flight models, data processing software and the technical expertise centre whereas EUMETSAT is in charge of operational exploitation of IASI. This agreement includes conditions on costs sharing, payments, and prices revisions. On technical level the agreement defined the tasks, responsibilities of the parties, the management plan, deliveries and planning.

The management of the project is based upon the Management Plan document which includes: documentation management, delay management, actions management, description of the supplies, process of the reviews, configuration control, product breakdown structure.

Then for the everyday management, different management charts are used such as the planning, the financial budget, the instrument performance budget, the critical elements list. All these charts are living along the project development.

It is *important* in such a project to define the responsibilities of each one. It is the goal of the Project Organisation Note which defines for each activity one responsible who is clearly identified and acknowledged by all; to gather all the transverse roles within the hierarchical project structure. It is *very important* to create a project culture.

It is also very important in such a project to avoid designing a solution just for the sake of technology: a link should be permanently maintained with the users in order to develop an instrument which will deliver attractive data for meteorological and scientific communities.

One of the most significant management issues with which any project developed in co-operation is confronted is to overcome the inertia in the decision process when several entities are involved in development as IASI program (Prime contractor and several agencies). In some case anticipation of the decision was necessary for saving delays necessary but in any case transparency and confidence should always be achieved.

Considering that CNES is concerned by the development of IASI and EUMETSAT by the exploitation, the relation between CNES and EUMETSAT could be seen as supplier/customer relationship. In fact, due a good confidence established between CNES and EUMETSAT a partnership relation prevails over a supplier/customer relationship.

Case-2 - Risk management and the Rosetta Project

AN EXAMPLE OF A RISKS MANAGEMENT CASE: THE ROSETTA PROJECT

1. RISKS MANAGEMENT IN SPACE ACTIVITY: AN INTRODUCTION

The complex character of the organisation of large projects gives a new vision about the risk notion. E. Dautriat, a former director of the Launcher Directorate of the CNES recently declared "Since the risk is inherent to any human activity, the question is to know how to discover it, grasp it, anticipate it, quantify it, and then take the corresponding decisions, in order not to suppress the risk – which is vain and which would sterilize any initiative – but to manage it".

E. Dautriat continues: "Application of risks management to industrial processes and to products is not new in itself. […] It demonstrates its efficiency in the nuclear domain and in space activity in particular. It is of course from the very initial phase of design that a dependability approach should be applied; but at the origin it does not aim at controlling this designing process itself. However, a dependability approach should now take into account the developing process itself, being aware of the difficulty even greater […] in the case of innovative projects"

These statements sustain the view that in a complex system such as large projects, risks deserve to be apprehended on a knowledge/information level.

According to A. Desroches an expert of risks management in CNES, taking a risk is associated to a set of information leading to a decision, actions and expected results. "The content of this information is situated in two distinct domains: [we quote here A. Desroches from "La gestion des risques" by A. Desroches, A. Leroy, F. Vallée. Hermes Science. Lavoisier 2003]

The *domain of the unknowable* is the one in which the elements cannot be defined or described in a qualitative and exhaustive manner simply because their existence is ignored. It is the domain of the unknown in which we cannot arrived in a rational or reasoned manner and often not even by imagination.

The elements of this domain are out of reach of the observer because they belong to an other time, in the past or in the future; they are too far; they are too small; they have not yet been discovered.

The *domain of the knowable* is the one in which the elements are defined in a qualitative and exhaustive manner. If their description can be done in a precise manner, it is not the case of their possible sequence. This leads to consider two zones in this domain:

In the *uncertainty zone*, to a given element can correspond many predecessors or many successors. That is to a given event is associated the set of its causes or origins and/or its potential consequences without being able to designate which ones.

In the *certainty zone*, an element corresponds to one and only one predecessor and/or successor. That is, to a given event, it is possible to designate it origin cause and its consequence with precision and guarantee.

The certainty zone covers the set of concepts, information and actions related to determinism. It is on one hand the "theoretical determinism" which corresponds to a fundamental principal such a physical law […]. It is on the other hand, the "statistical determinism" which corresponds to the always observed repetition of a sequence of events but not in a systematically and/or entirely explained way.

The events of the certainty zone are said to be certain or impossible, that is always reproducible under the same conditions of procedure and of environment: it is the place of the quality and of safety and more generally of regulations which are their vectors.

[…] Chance is therefore the consequence of a gap between the available information and the necessary information, which allow deciding the result of an experience. This gap has two origins: (a) the unavailability of information at a given moment because they are out of reach; (b) the complexity of the considered process or the number of pieces of information to be processed even if they are all available. This also covers the fastness of evolution of a process to reach a result"

The case of the *Rosetta mission* we describe below offers a perfect example of a risks management case where the delimitation of the available/necessary information domains as well as their evolution constitute a challenge for insuring is dependability.

Before entering into the details of this case let us recall the three types of risks that are usually considered in risk management activities:

- *Company risks* which are related to the perenniality of the company;
- *Project risks* which are related to (a) the performance of the product (which is targeted of the project), (b-c) the cost and time factors (for the project), (d) the safety of the product.
- *Product risks* which is related to the exploitation of the product itself: its availability, safety

It is currently the two last types of risks that are considered in space activities however the *company risks* are analysed and managed from time to time within space companies or agencies such as CNES.

2. THE ROSETTA PROJECT

The ROSETTA Mission of the European Space Agency (ESA) will study comet Churyumov Gerasimenko with which the probe has a rendezvous in August 2014.

(All the information about the Rosetta project can be found on the CNES site: www.cnes.fr in the "CNES programmes" entry, then "*Research and innovation*" entry then "*Rosetta*" sub-entry, or on ESA site: http://sci.esa.int/ entry 'Satellites in orbit', then sub-entry 'Rosetta status report')

After a period during which a global mapping of the comet will be realised by the orbiter, a closer observation phase will follow, including the sending of a module (Lander) down to the comet.

The launch, that took place the 2nd of March 2004 by an Ariane 5 launcher, will lead to a placing in the right orbit near the comet by August 2014 for an 18 month observation period.

The International Rosetta Mission was approved in November 1993 by ESA's Science Programme Committee as the Planetary Cornerstone Mission in ESA's long-term space science programme. The mission goal was initially set for a rendezvous with comet 46 P/Wirtanen. After postponement of the initial launch a new target was set: Comet 67 P/Churyumov- Gerasimenko. On its 10 year journey to the comet, the spacecraft will hopefully pass by at least one asteroid.

Few enterprises are more difficult or hazardous than space travel. Yet, even when compared with the achievements of its illustrious predecessors, ESA's Rosetta mission to orbit Comet Churyumov- Gerasimenko and deploy a lander on its pristine surface must be regarded as one of the most challenging ventures ever undertaken in more than four decades of space exploration.

Having overcome the time constraints associated with the launch, the hundreds of engineers and scientists involved in Rosetta are now about to face the ultimate assessment of their endeavour – the ability of their

creation to not only survive in deep space for more than a decade, but to successfully operate in the close vicinity of a comet and return a treasure trove of data that will revolutionise our knowledge of these mysterious worlds. The suite of 21 scientific instruments on board Rosetta will return data on how a comet behaves in the outer reaches of the solar system and what happens as it gets closer to the Sun, and reveal the composition and structure of its nucleus.

Because of its long travel the question of the knowledge preservation becomes a critical issues both for the mission and for the different instruments designed by the scientists. Later the exploitation of the scientific data, five or even ten years after the end of the mission, will represent a new challenge for the scientific teams involved.

How therefore to manage the project risks (associated to the probe and the lander mission) and the product risks (associated to the instruments and the corresponding scientific data)?