Project Albert + ROLF 2010 = Red Orm

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Introduction

In October 1995, at the direction of the Commanding General of the United States Marine Corps Combat Development Command in Quantico, two scientists embarked on what is now called *Project Albert*. The fact that this date coincides with the beginnings of *ROLF 2010* is not remarkable in and of itself. However, we believe that the intersection of the two efforts could, perhaps, turn out to be a collaboration remarkable not in coincidence, but in relevance. The two efforts, vastly different in focus, location, and methodology could, in combination, become a canonical example of non-linearity or at least exhibit the archetypical hallmark of non-linearity: the sum >> the parts.

This combination is still in the making and should not be construed at this point as anything other than a developing idea. But it has actually matured to the point of having a designation and has been named after the Viking exemplar of maneuver warfare: *Red Orm*. Here we'll summarize *Project Albert* and *ROLF 2010* before describing how they come together in the *Red Orm* project.

Project Albert

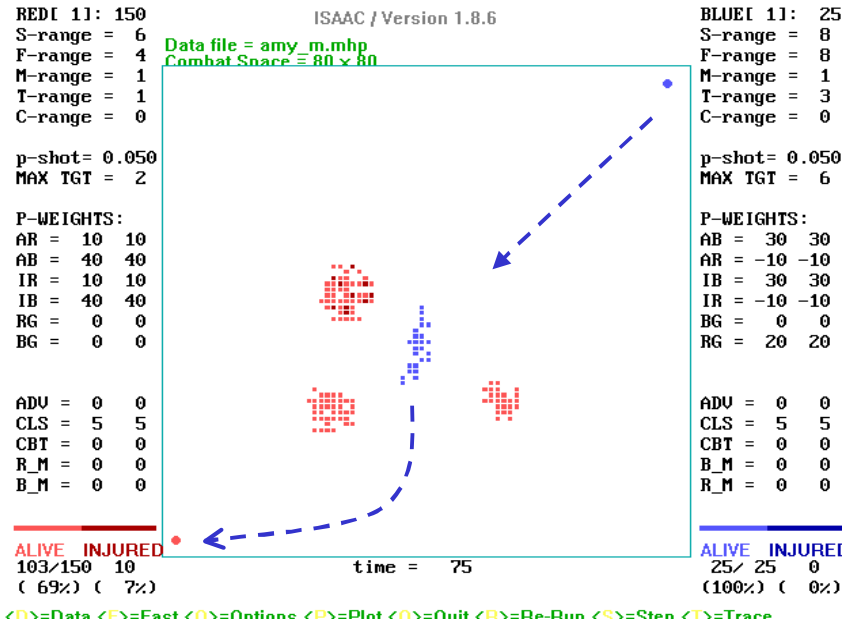
Project Albert uses a series of new models and tools, multidisciplinary teams, and the scientific method to explore questions. The approach utilizes the meta-technique called *data farming* to look at 21st Century questions from the perspective of the whole—and lots of data points are needed to explore this "whole". This meta-technique has been made possible by a convolution of advancements as the 20th Century closes. These include:

- Advances in agent-based models, which have the promise of capturing some of the adaptability and other key factors inherent in conflict.
- Advances in computing power, which enables us to increase our volume of data.
- Advances in our ability to organize, analyze, and visualize scientific data.
- Advances in concepts on how to integrate across the spectrum of operations research techniques.

Project Albert is a research effort, which embraces the process of *Operational Synthesis*; the focus is on looking at the whole rather than reducing systems into parts. This process is a complement to traditional Operations Analysis—it supports the study of asymmetries, risks, and potentials through the use, *inter alia*, of agent-based distillations. In summary, *Project Albert* is designed to develop new tools to capture emergent behavior in synthetic environments that over time will lead to more effective maneuver warriors.

The reference [Hoffman and Horne] describes some initial efforts by the Marine Corps to understand the potential mesh of the nonlinear sciences and complex adaptive systems with the study of warfare. One such effort is the development of an agent-based model called ISAAC, a mobile cellular automata model in that the individual fighting entities, called agents, move through a lattice and carry information with them as they go. The agents are given characteristics which include: a default local rule set specifying how to act in a generic environment, goals directing behavior, sensors generating an internal map of environment, and an internal mechanism to alter behavior. The figure below is a snapshot (with arrows added) of the ISAAC distillations. We have ported ISAAC to the Maui High Performance Computer and run it many millions of times as part of a process we call *Data Farming*. This process is described fully in [Hoffman and Horne]. Briefly, what we try to do is grow data in the area of interest that provide insight into the answers to our questions. The fundamental underlying principal here is that we need to look at a vast landscape of possibilities because of the uncertainty inherent in and the nonlinear nature of conflict. Thus our research so far has concentrated on methods to create, access, and understand large amounts of data from distillations.

Figure. ISAAC snapshot.



In the ISAAC distillation depicted above, the first group of parameters represents capabilities such as sensor and fire range. The next group of parameters, or "p-weights," represents the "personalities" of the agents, or how they will move and select strategies. This is done by inputting a set of weights, which are used to rank possible moves according to the agent's proximity to the various types of agents and goals. The other inputs represent another tier of adaptability, perhaps sociology, whereby the default personality is altered according to local threshold constraints. And finally, below the dark lines we see a tally of alive and injured agents—one "hit" creates an injury and two removes the agent from the play.

The reference [Hoffman and Horne] describes some of the initial research efforts using ISAAC. One of the key areas of research is the examination of the role of intangibles such as cohesion, trust, and leadership in warfare. It should be stressed that these efforts are merely illustrative to this point. However, the next generation distillation, that we call Archimedes, has just recently begun beta-testing at the Maui High Performance Computing Center and research has started on applying this new distillation in real ways to real questions.

Rolf 2010

ROLF stands for "Rörlig Operativ LedningsFunktion", in Swedish. Translated into English this means " Mobile, Joint Command and Control Function for the year 2010". The concept is not solely intended for military applications, but has also been discussed for other uses, particularly within the field of total defence, e.g., for commanding peacetime rescue operations, and international operations.

Three things are different with the ROLF concept, compared to similar resources. First, the staff ROLF depicted in the figure is quite *small*, a second difference is the *seating*, and the third is the nature of the *display*.[1]

A. The staff concept should be seen as a network of centers for excellence rather than individual cells of staff being united. Specifically, this means that different nodes, staff elements, in this network will work with different issues concurrently. In the initial architecture the intention is that a complete staff unit will include at least four staff elements. In order to create a robust network, there are a number of small and mobile elements that are less vulnerable than the traditionally big staff units. However, the size has certain implications.

- Despite its smaller size, the ROLF staff still must do almost the same work as a traditional staff. The interconnections made possible by modern information technology may support this workload and relieve the staff of much of the need for co-ordination of the units.
- Work in the ROLF staff is likely to be quite intense, requiring a number of shifts. This highlights the attendant problem of keeping continuity of command and control action despite the changes in personnel.

B. The complexity and the dynamics of the command and control situation for a ROLF staff are assumed to create high uncertainty. It is reasonable to believe that no human could manage this environment by himself, and thus expert knowledge and competence must be instantly accessible. Other resources can be accessed through the net. In order to handle the situation a management team must be seated close together, in this case around the same table. The seating is chosen to facilitate the co-operation. We think that the seating around the same table will create at least two different advantages in handling complexity and dynamics.

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[1] Brehmer and Sundin (un-published), "Joint and Coalition Command and Control for the Digitised Battle Space: A Swedish view", soon coming book in the National Defence College research series, ACTA

- we believe that *successful communication* under the stressful conditions of battle is close and physical. This is the form of seating that humans have always chosen when they have serious matters to discuss, from the gathering of the early stone age people around the camp fire to the conference tables of modern board rooms. Serious discussions are possible only if psychological distance is minimised. There must be an opportunity for full communication, including body language and eye contact in order to gauge the mental state of the other persons in the staff.
- the seating creates a *common focus*. There is a common display of the situation that the staff members can refer to in their discussions. This should facilitate the development of shared situational awareness.

C. In order to illustrate and visualise the situations in different perspectives over time in a collective image in front of each participant in the staff element or in a number of elements, ROLF deviates from traditional means of combat representation. Traditionally, in the military environment there is a presentation of a 2D map that shows the so-called *battle room*. We believe that it is possible to present more informative situation maps by using new technologies and 3D, as well as multimedia techniques. This will improve not only the support for a trained group of individuals but also, hopefully, the perception of less highly trained people such as media representatives and politicians. The two main reasons for searching for new forms of presentations are:

- At the same time as 3D solution is assumed to improve the perception, they also involve the risk of adding complexity. In our view, the need for a 3D display is a consequence of the new concept of *battle space*. The battle space concept refers to a *volume*, rather than a *surface*. The fact that the battle space must be constructed mentally by each staff member raises the possibility that different staff members may construct different representations and this in turn may lead to misunderstandings. There may be little chance of sorting out these misunderstandings during the hectic pace of modern battle.
- To support the decision process by improved ability to interact with the presentation. This is enabled by manipulation of the symbols in the representation directly by grabbing and moving them around and illustrating one's conception of the possibilities for action in the battle space. This is assumed to facilitate the dialogue between the participants in the environment, in the room as well as elsewhere in the network.

Red Orm

Red Orm seeks to significantly advance the state of the art in command and control. It focuses on *human* decision making processes, vice *techno*-centric decision environments. As such, its objectives are to discern, investigate and leverage key attributes of the decision-making milieu:

- non-linearities of warfare – *the influence of initial conditions and dynamics inherent in conflict*
- intrinsic human characteristics of warfare – previously *unquantified attributes of fighting forces (e.g., trust, leadership, elan, fear,…)*
- co-evolving landscapes – *the codependent adaptation of forces within the crisis-space*

- crisis learning processes– *adapting behavior to leverage own strengths and exploit opposing weaknesses to optimize mission accomplishment*
- crisis-space uncertainty and complexity – *effectively managing and exploiting the "fog and friction" of conflict and crisis*
- multi-dimensional reasoning – *the human affinity for spatial environments, symbolic representations, common understanding of the crisis-space, and behavioral connotations in command team decision making*
- time criticality – the preeminence of the temporal domain in crises and an awareness of the time-uncertainty trade-space

In support of the above *Red Orm* objectives, the plan is to mutually extend and collaboratively integrate current areas of research to generate a prototype command and control laboratory. Prototype development will be achieved through a process of evolutionary enhancement. The American partner will apply their expertise in *data farming* and new methods of modeling and simulation. This will be extended to encompass multi-resolution/variable granularity command behaviors, planning, course of action analysis, and crisis-space characterization and response, all augmented by high performance computing. The Swedish partner will apply their expertise in innovative command and control environments. This will be extended to encompass development of interactive, multi-modal, aspect-dependent, human-centric perception tools for command and control settings.

In summary, we anticipate that in *Red Orm* the two partners will cooperatively investigate and develop user interfaces that integrate *Project Albert* and *ROLF 2010* efforts, hopefully culminating in a working laboratory that will enable accelerated command and control innovation by both parties. And, in conclusion, we state our ultimate goal: to develop better ways to make decisions.

Reference

F. G. Hoffman and Gary E. Horne. *Maneuver Warfare Science 1998*. Quantico, VA: Marine Corps Combat Development Command, 1998