CONTROL ENGINEERING AND INTERNATIONAL CONFLICT RESOLUTION

Report on the

IFAC/SECOM Working Group

"SUPPLEMENTAL WAYS FOR IMPROVING INTERNATIONAL STABILITY (SWIIS)"

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1. Introduction

Today's world is a complicated system. To work well, it must be stable and able to change in an orderly way. A desirable objective is to increase the likelihood of the people living at peace by improving stability among nations.

Use science and technology for constructive purposes

Science and technology can be used for a better world in the years ahead or they can be used for destruction and ruin of civilization as it is presently known. The skills of management and leadership should be directed to strengthening the ways for changing our ways of living toward a civilization that has a more sustainable future.

This is a report of the IFAC WG on SWIIS, dealing with:

- Aims
- Assumptions
- Activities and accomplishments
- Findings and understandings
- What is to be done now?

A need exists for ways of preventing nuclear war that could threaten the end of the present world civilization. Although most world leaders agree that there would be no winner in a present-day nuclear war, there is considerable concern that some minor conflict between nations might escalate into a full-scale nuclear war among the major nuclear powers (Powers, 1985). In an effort to improve international stability, a continuing study is underway to seek ways to use technology to improve the means for resolving international conflicts - in particular, before these international conflicts reach the condition of war between major world powers (Chestnut, 1986). The subject of ways of applying adaptive control principles to resolving international conflicts has been presented to the IFAC World Congress 1987 (Chestnut, 1987).

There is a basic need for national security that can provide a safe environment in which the technically advanced systems that are in existence, as well as those being built, can be used effectively to help people to realize the benefits that are possible with the present-day high technology. Industrialized capitalist, socialist, as well as various other national economic systems all require a peaceful environment, in terms of the relationships between these countries, for the benefits of advanced technology to be made available to the people of these nations. The recognition that the

relationship between nations can change with time, ranging from various conditions of peace to various conditions of war, should make it possible to develop some sort of adaptive control means for decision-making that will endeavor to bias the relationship between countries in the direction of more peaceful conditions over time (Chestnut, 1986).

In what way can control and systems science contribute to international realtions stability? Systems consisting of humans are also systems, although human systems are much more complex than many others. Technical systems are both cooperative and competing when looked at from the points of view of overall efficiency and survival on the one hand or on the other hand from the sharing of resources or allocations. The differences between technical systems and those of humans lie in complexity that may be several magnitudes greater for human systems and in semantics related to this complexity, i.e., different and fuzzy definitions of goal functions and values for human rather than technical systems (Rouse et al, 1982), (De Greene, 1982).

The first problem, the control of larger scale dynamic systems for maintaining their stable and efficient operation, was and is a traditional area of system research. The second one, understanding semantics and relating different definitions of concepts, is the research field of artificial intelligence, especially expert systems, as well as the areas for political science, social science, econcomics and human behavior. Theory and experience worldwide of operating cooperative service systems such as postal, telephone, TV, road, railway and air transportation, food, commercial and monetary systems prove stable operation of these systems is possible, although they contain the motivations for competition, contradictory operations and the possibility for instability.

The research is and should be absolutely neutral from the political point of view; it has the task to provide objective tools for the people who are conducting the political decisions and have need of objective measures for evaluation of policies. The results of this research should also be useful for all other people who would like to watch and understand the important decisions which deal with the future of mankind. If our efforts are not objective and non partisan, they can not be of help anyway; and if at present we can not provide more objective algorithms and bases for negotiations, then systems science efforts must be expanded to enable better solutions to the problems of international stability in the future.

2. Aims

On May 2nd, 1980 the following aims for the IFAC WG on SWIIS were presented to the IFAC Executive Council.

The aims of the IFAC Working Group on SWIIS will be accomplished by such activities as the following:

1. Examine work currently taking place in the areas of peace research, conflict resolution and other associated arts and skills for reducing the risks and likelihood of international instability.

2. Identify apparent obstacles to the realization of a more peaceful and stable set of international relations.

3. Identify information sources which may provide indication of leading events for various nations or groups of nations that may describe conditions of normal, alert, and emergency operation for various potential trouble spots in the world.

4. Develop possible courses for action to resolve situations corresponding to alert and emergency operation.

5. Illustrate through cost benefit analysis potential advantages and disadvantages associated with various forms and degrees of instability between nations.

6. Seek out forms and means of education for different ages or levels of educational training that may be appropriate to produce conditions favorable to international stability. Examples: formal curricula for classes at the elementary, secondary, and collegiate levels; TV and other material for adult and continuing education; and exchange visits between groups in different countries at various age levels.

7. Identify possible conflict resolution means to facilitate fact finding, arbitration, and other information handling sources and means to increase the likelihood of international stabilty.

The above suggestions are representative of some ideas which the IFAC Working Group on SWIIS should consider in its fact finding, data gathering, problem definition, and suggestion making activities which should be reported back to IFAC and other appropriate and interested organizations.These aims of the IFAC SWIIS WG were accepted by the IFAC Executive Council and have been the guiding priciples of this Working Group.

3. Assumptions

In defining a system such as an information system for helping to resolve international conflicts, it is necessary to describe the basic underlying assumptions that are to be included in the system that is to be developed. The following are examples of some typical assumptions that could be set forth to provide an indication of the nature of the sort of assumptions that could influence the international conflict resolution process and the associated system to make it operational.

1. The international system is made up of sovereign states. Each nation is assumed to be looking after its own interests as far as national security is concerned, although in some instances a country is willing to be associated with one or more other countries in some sort of protective alliance.

2. International conflicts are inevitable. The advent of greater interdependence within nations as well as between nations has heightened the likelihood of conflicts since people with different needs and interests share common facilities and activities (Kile, 1982).

3. There are organized procedures for resolving conflicts. Within each nation there are one or more ways for resolving conflicts that are used to settle disputes. Although there may be drawbacks to each of the methods involved, in general all of the methods employed try not to use military force as the basis for conflict resolution within the nation (Fisher and Ury, 1981).

4. Potential areas for conflict needing resolution can be identified. In order to make progress toward successful conflict resolution, it is desirable to

identify potential areas where conflicts might arise, to establish groups from the two or more nations involved, and to assign to these groups the responsibility for reducing the likelihood of conflict in their assigned category.

5. Measurement means and criteria for monitoring can be found. Of particular significance in the matter of international conflict resolution, is the matter of whether the parties involved consider the conditions to be normal, alert, or emergency vis-a-vis the other country.

6. Various possible alternative actions can be explored. Through the use of models, simulations, discussions with knowledgeable experts from both the nations involved, as well as with third-party experts, it should be possible to get various impressions of what may be the possible outcome of various alternative actions.

7. Incentives and motivations for peace can be developed. In each of the countries involved the people responsible for the decision-making that causes a country to go to war can be provided with various incentives for keeping the nation out of war.

Although the list of assumptions noted above may be found to be unacceptable for certain particular conflicts requiring resolution, it should be possible to replace these assumptions with still other assumptions that can be mutually agreed upon by the parties concerned with the conflict resolution process.

4. Activities and accomplishments

The Working Group (WG) on "Supplemental Ways for Improving International Stability (SWIIS)" was installed in the Technical Committee of "Systems Engineering (SECOM)" on the "International Federation of Automatic Control (IFAC)" in the year 1981. The main goal of the Working Group is applying well known methods from the field of Systems Engineering for tasks of conflict resolution. In this sense, conflicts might be considered as a stability problem in a dynamic system.

Trying to realize this idea in the last six years, interested scientists from engineering (especially control engineering) as well as from other disciplines: e.g. sociology, economy, political sciences, international relations, medicine etc. were contacted. The first exchange of ideas occured at the first Workshop on International Stability which took place in Laxenburg, Austria in 1983. During this event surveys and technical papers dealing with various aspects of SWIIS were presented and discussed (Chestnut, Kopacek et al, 1984). Some of these papers presented in revised form at the 9th IFAC World Congress in Budapest in 1984. Considering the three year cycle for IFAC events, the next IFAC Workshop on this topic was held in Cleveland, Ohio in 1986. The next Workshop will be held in Budapest on June 5-8, 1989.

During these years several members of the Working Group have contributed to meetings related to international stability in conjunction with other conferences of other organizations. For example in 1987 at the conference of the "International Society for General Systems Research (ISGSR)" in Budapest two meetings on international stability were organized. In July at the 10th IFAC Congress in Munich the SWIIS WG sponsored two sessions on "Technology for Improving International Conflict Resolution" and also held a meeting of the Working Group. In August three days of meetings were held in Grand Rapids, Michigan with the AMIS organization, which is devoted to "Alternative Methods for International Stability". In October, four sessions on "Technology for Improving International Conflict Resolution" were held with the IEEE Systems Man and Cybernetics (SMC) Society in Arlington, Virginia. 1987 was a very busy year for the SWIIS Working Group and thanks are given to the many people who contributed to the success of these activities.

Seven papers presented in the 1988 special issue of the Journal for Systems Research were part of a two session mini-symposium on "Systems Engineering for Peace Research" which took place on April 5 and 6, 1988 in the "Ninth European Meeting on Cybernetics and Systems Research'88 (EMCSR) in Vienna, Austria. At this event a meeting of the NAMIS (Network for Analytical Modeling of International Stability) project was held. This project group was founded during the AMIS Workshop in Grand Rapids in 1987 and now has members from seven universities.

5. Findings and understanding

The closed loop principles of control should be applied to making an improved information system for the US, the USSR and such other major countries that are

willing to join in the efforts to provide improved international stability and a more peaceful world. Currently there are insufficient efforts being made to develop more effective methods for establishing objectives and goals for a more peaceful future and for ways and means for achieving these objectives and goals.

The principles of closed loop control have in many cases enabled people to obtain far more desirable performance from man-machine systems than when such principles have not been employed. These closed loop principles involve (1) providing a reference signal to a process (2) comparing that reference with the measured performance of the process, and (3) using that difference to provide a basis for control of the decision-making process. In the case we are considering here, the reference can refer to the objective of resolving international conflicts without resorting to using military force (Chestnut, 1987).

Adpative control priciples recognize that a system may have many different parts or conditions of operation and that the reference or desired operation of the system may change with time or other conditions of system operation. An adaptive control is one which determines what are the present or other measured or estimated conditions of the system and which alters either its reference or its method of control to accommodate those present and estimated future conditions. "An adaptive control changes the control parameters or the control response in accord with other changes in the system to improve overall system performance. The objective of an adaptive control system is to have the control self-adjust or to self-optimize the system performance in the light of changing systems conditions" (Chestnut, 1965). The adaptive principles should be considered as a way of helping people make better decisions rather than to emphasize the automatic features of the control principles.

Although control principles are not customarily associated with international relations, there may be some significant advantages in seeing how international relations may benefit by suitable use of adaptive control concepts and methods. In particular, emphasis can and should be placed on recognizing that the characteristics of people and countries can and do change with time, over short (days), medium (weeks and months), and long (years and decades) time periods. In many cases the control and systems engineers have designed, built and operated the systems that are essential for the nation's people to live the way that they do. These control people may have considerable knowledge and awareness of the changes that are possible and desirable. Likewise politicians, business people, military people and others should be

aware that the nature of the relationships between nations can and should be flexible and adaptable so as to reduce the likelihood of international conflict and war.

An important factor for a successful security system to exist between nations relates to providing information for a realistic awareness of the expectations and hopes, as well as the fears, of the different groups of people in the nations involved. These attitudes of the various groups of people in a country may range from conditions of confrontation, to competition, to cooperation, with differing degrees of these conditions being possible on particular issues or situations. Through the use of a Cooperative Security System such as has been described elsewhere in some detail (Chestnut, 1984) it should be possible to make more effective the efforts of people in the different nations who share the various beliefs that cooperation, competition, and/or confrontation can lead to successful ways of keeping peace among nations. Increased emphasis on cooperative methods for improving international stability is essential at this time.

Other factors for consideration in the process of increasing international stability and fostering peace among nations are the current state of the various relationships between the nations involved and also the nature of the prior relationships between the countries. Regarding the present state of the relationships this refers to whether these relationships are normal, alert, or emergency. Depending on which state the relationships are in, the sort of action which might be appropriate may be quite different. Regarding the prior relationships between the countries, it should be noted that it may take decades or generations to develop cordial relationships between most people in different countries; to terminate peace between countries may be done in a matter of moments. Much more effort should be made to continue peaceful relations when they exist between countries.

A number of articles have described the use of closed-loop control principles as well as the adaptive control and the predictive control principles of a Cooperative Security System (Chestnut, 1984, 1985, 1986, 1987). A CSS involves an international information system which includes people from two or more nations concerned with providing these nations with a common security system. In addition to sharing measurement data, a Joint Review Board meeting at regular intervals, or on request, would work to identify potentially difficult or dangerous situations before they become critical and to set into motion suitable conflict resolution means if they were considered to be needed. Stronger emphasis should be placed on preventing wars

from occuring in addition to the present preoccupation with winning wars once they are started.

Traditionally, an ongoing effort has taken place in many countries throughout the world to have peace by avoiding conflict. Unfortunately it has not been possible to avoid conflicts even at the very fundamental level of the individual family. Rather than to try to avoid conflicts by rules or fiat, a more likely way for resolving international conflicts is to identify conflicts in their early stages and to develop and establish more effective means of conflict resolution as a way of settling international disputes. By mutual efforts to establish common bases for identifying incipient conflicts as they develop, by sharing perceptions of the importance of conflicts of interest, and in general using shared information of causes and effects, it may be possible to develop more acceptable and less destructive ways for resolving international conflicts than the current military force methods of solution (Fisher and Ury, 1981).

6. What is to be done now?

Plan for future:

- Continue conferences
- Identifiy organizations and people in various countries that are working for peaceful resolutions of international conflicts
- Strengthen the effort and effectiveness of the use of international modeling and simulation as a way of helping to make decisions for a more peaceful future.

A Cooperative Security System is a large undertaking that covers several different countries and long time intervals. It should be better known, better planned, and better supported. Much of the Cooperative Security System activity is dependent on the concept of stability. A better understood description of what is stability is needed. Stability should permit change as something which is desirable and is acceptable to the persons being affected.

The people of the world are in a period of very rapid change and more people exist than ever before. And the expectations of many people are greater than ever before. There is an unusual opportunity to use new found information handling skills which

are relatively less demanding of energy and materials. Or we can squander our opportunity and be unable to meet the needs of future people and their civilizations. Let us work more effectively for helping to provide the desired better future.

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