

Considerations about present Research and Development (R&D)

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Abstract

1. A leading role in **today's** market economy implies to comply with the main recent economic trends and the relevant results from **Research and Development (R&D)**, which however originated several decades ago because of the so called **reaction time delay** effect. A leading role in **tomorrow's** market economy implies to observe and use the present results, but **simultaneously** to invest in complementary R&D projects, especially those which are conceived under the motto "**Excellence for Excellence's sake**", since this will "produce" the optimal innovation probability. **Space Research** not only requires excellence but is also a unique possibility to practice it. See also figures 1 and 3.
2. In times of weaker (national) economies the (governmental and often also private) R&D funding in general decreases and thus forces us to strive for better disposal knowledge, which comprises the development of "**smarter processes, systems, and products**". According to biocybernetic rules, it should not decrease. These biocybernetic rules are direct related to Genesis 1, 41, 34-36, which tells that man should save 20% in the seven fat years for the seven poor years. Many governments have disregards this since about 30 years and thus R&D funding decreases. The less resources (funding) are available, the more must be invested in the – hitherto fairly disregarded "further development" of successful so called "prototype" or old processes, systems, and products. Economizing the R&D activities implies that the two should be better balanced in the low tech as well as in the high tech area. The further development is a major goal of the proposed **DEREMOTOX** pilot project. See also fig. 2.
3. The complexer (non linear) systems get, the more specialization and globalization grow, the more interdisciplinary and intercultural cooperation is required. The more simultaneously bureaucracy increases and the more R&D funding decreases, the more "**human catalysts**" are required – in addition to normal management - to reduce or overcome the accompanied problems for R&D activities. The term catalyst was chosen by G. K. Hartmann in analogy to a catalyst in chemistry, meaning that a human catalyst must **recognize and bridge over** differences – especially intergenerational, interdisciplinary and intercultural ones - in a (positive) synergetic manner and be able to reduce the so called "page syndrome" which means that he or she helps to reduce fears that prevent that (important) rational insights (thinking) are transformed into relevant actions. This is partly complementary to normal managing, but more inconspicuous, i.e. in general without attracting attention and publicity. The less charismatic the catalyst – "the grey eminence" - the less successful can R&D projects be started and executed. Since there exists no theory of intercultural cooperation yet we can only develop it – with catalysts - through concrete R&D activities, common teaching and learning (education) tasks, especially in economy and ecology.
4. **Complementarity** is an existential given fact which man must ascertain and which replaces for many appearances either or through as well. Complementarily in the sense of Niels Bohr (1928) - he conceived this term recognizing that man is not only spectator/observer but also fellow-player in the drama of life - means: a) Being occurs in

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two different appearances that are (logically) irreconcilable. b) The more one comes into focus the more the other loses focus. c) The two cannot be segregated (fragmented).

5. (Empirically based) **Science** contributes to a better way of seeing oneself in relation to the cosmos, complementary to the transcendence, enables technical and technological developments, and it is for the scientists a pretentious possibility of self-representation
6. Information is "created" by a filtering process, i.e. is time dependent. Information contains preliminary certainties which are made prominent against the determinable uncertainty. Information is "created" in the complex of NOUS-GNOSIS-PHYSIS-MYSTERIUM that relates the person who cognizes (NOUS) and the cognition process (GNOSIS) to the appearances (PHYSIS) and the unknown, hidden (MYSTERIUM).

Remark: These aspects gave rise to the pilot project proposal **LEDGEM**, drafted in June 1998 by G.K. Hartmann. (LEDGEM: Local Eco-village System Development and Global Environmental Monitoring, e.g. with MAS Follow-on). See fig. 1 – 3. The very successful synergetic combination between an (administrative) managing (G. Schneppe) together with a (catalytic) Principal Investigator (PI) was demonstrated with the Space Shuttle experiment MAS.

(The **Millimeter Wave Atmospheric Sounder (MAS)** experiment which as a joint enterprise of Germany, Switzerland, and the USA has been flown as core payload of the NASA ATLAS (Atmospheric Laboratory for Applications and Science) Space Shuttle Missions: ATLAS –1 (1992), ATLAS-2 (1993), ATLAS-3 (1994); http://www.mpae.gwdg.de/mpae_projects/MAS/)

1. The role of knowledge for the production

Man as an unspecialized curiosity being needs information for survival. This comprises various types of knowledge, e.g. cognition knowledge, disposal knowledge, and order knowledge. "The significance of **knowledge** in the value-adding process is today just as great as that of the three classical production factors: **labor, land, and capital**. In addition, knowledge in "unattached" form - for example in patents, processes and freely available knowledge - increases the productivity of the other production factors, principally that of work. This enables business to reduce their personnel requirements and increase their return on capital". This statement, made for western national states like Germany by M. Miegel, IWG, Bonn Germany, 1998, needs to be supplemented and modified with respect to countries and areas which have not participated in the "first wave industrial development" and to those industrialized countries with fast increasing - especially anthropogenic - produced environmental problems. First of all the just mentioned classic three production factors must be supplemented by water and air. For all three "**existentials**": **air, water, and land** we have to care for a quality that allows (human) life and which is the **precondition** of any human activity and/or productivity. In an increasing number of regions where human beings live – often since a longer time span - this precondition is no longer fulfilled or the relevant quality (standard) has begun to deteriorate. There we cannot think about using knowledge and capital to reduce work. We have to use labor and knowledge to (efficiently) restore and/or newly create - with as little as possible capital - the necessary preconditions for direct survival and for an onset of future (market) productivity and trade activities. We have to strive for an optimization of technologies and processes - see fig. 1 - used and developed within socio-economic-ecologic-technologic, cultural determined "systems", briefly called "**smarter**" systems (12), i.e. with smarter products/technology. This will allow (**mass**) **production of resource efficient, labor intensive, long-lived, low cost, simple/user-friendly (basic) goods (i.e. technical modules)** and is based on:

1. a synergetic R&D combination of hardware and software from the relevant, but complementary low tech and high tech areas, leading to real (future) innovations.
2. thorough testing, evaluation, and "invaluation" of the results, - mainly based upon non linear biocybernetic thinking and system control. This essentially means for the system under consideration: a) minimization of energy and matter fluxes, b) the existence of negative feedback loops, e.g. through anticyclic planning for the stability of the system, c) conserving the evolution principles: *diversity, mutation, selection and isolation*.
3. Improvement of the techniques and technologies used at present, amongst others through a combination with already available but not yet used "prototype like" products and/or processes. This is proposed in the pilot project **DEREMOTOX** .

This leads not only to a (local) decrease of unemployment but also to the "creation" of new markets. The less these actions are based on interdisciplinary, international and intercultural – not to forget intergenerational – co-operation, the less meaningful results can be expected. The increasing number of ethnic groups – nations in its original sense - within many national states force the citizens and governments – the more hostile the encounters get – to think and worry much more about **intranational-intercultural cooperation**, if they want to avoid or at least to reduce wars like the present one in Kosovo. However, also **international-intercultural cooperation** must be intensified because of the increasing globalization, especially the increasing influence of the big multi- or trans-national corporations and that of non governmental organizations (NGOs). This intensification leads to difficulties – as we can realize every day - because there is no theory yet of intercultural cooperation. This means that as a condition of meaningful cooperation between the cultures mutual understanding and recognition can only be achieved through **concrete cooperation** in the fields of R&D,

common teaching and learning (education) tasks, economy and ecology. It should be mentioned that recognition is much more pretentious and difficult than tolerance alone. The famous German poet Johann Wolfgang von Goethe wrote about 200 years ago that tolerance must be a transitory behavior and that recognition must be the ultimate goal, since tolerance in the long run offends the others. Such (successful) intercultural cooperation based not only on competition but also on symbiosis, can help to reduce the socio-economic-ecologic induced threats of large migrations of the poor and also the danger of ethnic cleansing. This also implies that the less the "classic" management tasks can be complemented by so called **catalytic functions** the less successful (efficient) these projects will be. The term catalyst was chosen by G. K. Hartmann in analogy to a catalyst in chemistry, meaning that a human catalyst must **recognize and bridge over** differences – especially intergenerational, interdisciplinary and intercultural ones - in a (positive) synergetic manner and be able to reduce the so called “page syndrome” which means that he helps to reduce fears that prevent that (important) rational insights (thinking) are transformed into relevant actions. This is partly complementary to normal managing but more inconspicuous, i.e. in general without attracting attention and publicity, acting like a “grey eminence”. The less charismatic the catalyst, the less successful can R&D projects be started and executed. Since there exists no theory of intercultural cooperation yet we can only develop it – with catalysts - through **concrete R&D activities**, common teaching and learning (education) tasks, especially in economy and ecology.

Remark: *The great importance of such a catalytic function for the success of complex, international (scientific technological) projects has been demonstrated by G.K. Hartmann:*

1. *In his role as the Principal Investigator (PI) of the MAS (Millimeter wave Atmospheric Sounder) successfully flown with the three NASA ATLAS Space Shuttle missions in 1992, 1993, and 1994 (1, 2, 11) and http://www.mpae.gwdg.de/mpae_projects/MAS/).*
2. *As honorable, external scientific director of the environmental institute IEMA and professor (titular) of the University Mendoza (UM). (The UM-MPAe cooperation began 1983).*
3. *As senior scientist in various other international projects, since 1964 as tutor of several DAAD fellows and two Alexander von Humboldt research awardees from the U.S.A., and since about 20 years as "consultant" for information problems of the Institute of Intercultural Research (Heidelberg/Zürich/Pernegg).*

2. Basic Research and Space Research

It is not possible to justify Basic research and Space research with quick capital return. It is a cultural endeavor and an investment in and for the future. However, regarding Space research and the related Research and Development (R&D) activities it contributes to today's quality of life in the following way: a) through necessary and possible global monitoring, b) through fascination and (national) prestige, through the “example function“ of the result from projects executed under the motto “**excellence for excellence's sake**“.

Remark

The most important milestones in space research and space technology in this century have been created by Russia and the USA, (Sputnik 1957, Apollo 1969). As a consequence of the oppression and isolation during the Soviet ideology (USSR), the disappointment after the lost "cold war" , and as a consequence of the present bad economic situation the space research program of Russia is in a deep crisis. The space research program of the USA can be characterized by commercialization respectively "enterprise". This brings it always closer to

an everyday subject and thus its continuous budget cuts are understandable. At the beginning of the 21st century - in context with its international space research and technology program - Europe and/or others might be able to set an impulse for a new orientation of this program, e.g. under the above mentioned motto, and thus can better justify and maintain a reasonable support than Russia and the USA. Since a trip to the "inner human space" by means of virtual reality (VR) in the cyberspace is a lot cheaper and also easier than a trip to the outer space, private and public support might further decrease for the latter if we stick to the old paths or can not make (outer) space again more attractive. Is the European (science) policy or any other capable and ready to meet this challenge and to accept this new "in-between" for Space research between Russia and the USA? It must be located between a (Russian) antipositivism and an US "romantic pragmatism" and might initiate a new (common) understanding for the meaning of science. The geographic location of Europe, its cultural history, and the very recent East-West experiences offer a unique chance and challenge. Will Europe make use of it? If yes, then not only a more profound (inner- and intercultural) East-West dialog and a cooperation will be possible but also similar consequences can be expected for the North-South cooperation and the cooperation with Asia.

The less longer term thinking and planning influences political decisions the more the scientific community must take into consideration these facts. Thus it is suggested – according to cold war and post cold war experiences that more funding applications should be dominated by the principle excellence for excellence' sake. This would “put away“ – in a figurative sense – the complementary poles applied science and basic sciences (indistinguishable) in a higher dimension, which provides more and better space for real (exceptional) surprises (innovations) than in the lower “either or dimension“, where basic science and applied science are opposite and are dominated by strategic and programmatic planning. This, however, is later often proven wrong because of the open nature of science and the non linear (complex) systems. The complexer and more non linear the systems get, the less linear technocratic thinking and planning will be successful and the more we need to rely on the old method – very successfully applied by nature – of **trial and error**. The increase of specialization, i.e. the increase of the division of labor, together with an increase of bureaucracy implies that increasingly more people who are authorized to make decisions are less competent – they continuously get further away from the basic work - and that on the other hand more competent people, directly connected with the “basis”, are not authorized to make decisions. An increase of the **“healthy” middle class**” in all domains is required to reduce the negative effects and increase the stability of the “system”. (Healthy means: motivated, capable, competent, willing to participate and to take responsibility, having a concept of oneself). The system stability is especially endangered by the increasing **time shortening** effect caused by exponential growth phenomena. This time shortening was already 200 years ago denoted by the famous German poet Johann Wolfgang von Goethe **"velociferic"** , created from the terms *velocitas and Lucifer*.

Today the major (technological) challenge lies in a **more caring ("conserving") utilization** of renewable and non renewable resources, which especially means striving for *higher resource efficiency (productivity)*. If one deals with indispensable, necessary resources, "our air", i.e. our Earth atmosphere, then taking care must be changed into a stronger, real conserving utilization, which includes monitoring and safeguarding the quality of "our air". Similar statements must be made concerning the pollution of the water and the soil, i.e. we must keep the pollution below the lethal, hitherto quantified toxicity levels. This implies that economy and ecology must be led to a (positive) synergetic combination and must be "liberated" from the (artificially, unnatural, mutual) hostility, which has led to regression and partly already to destruction. The "logos of the oikos", i.e. the "sense of the house", and the "nomos of the oikos", i.e. the "rules of the house", **can principally not be segregated from each other**. If this is nonetheless tried the resulting "Either-Or" position leads to many

negative consequences caused by "one-sidedness". The "As well As" position was related in 1928 by the famous Danish physicist Niels Bohr to the term **complementarity**. It includes ambivalence but means more. Bohr's understanding of complementarity is principally different from that of pragmatism which denoted the various aspects of an appearance as complementarity.

Complementarity in the sense of Niels Bohr - he conceived this term recognizing that man is not only spectator/observer but also fellow-player in the drama of life - means:

- *Being occurs in two different appearances that are (logically) irreconcilable.*
- *The more one comes into focus the more the other loses focus.*
- *The two cannot be segregated (fragmented).*

*Complementarity is an existential given fact which man must ascertain and which replaces for many appearances either or through as well as. In those cases we experience and have to unavoidably endure tensions. The striving for an either or attitude means to reduce the "two-sidedness" tension through "one-sidedness", i.e. transform it in a lower dimension - with all its (negative) consequences. A realistic living with an as well as attitude means - according to the understanding of the author - a striving for "putting away" (conserving in a figurative sense) the (logically) irreconcilable poles in a higher (third) dimension which also means another (higher) quality. The terms **differentiation and integration** - only in their original mathematical sense - might explain this in other words. Here the significant difference to the daily (political), mostly unreflected, use of the term integration becomes very obvious. Elements of the paths towards a higher quality can be described amongst others by:*

- *striving for a **dynamic equilibrium** between the poles, e.g. between the inner and outer nature of the human being or between "dealing out and pocketing".*
- *acting as a "(human) catalyst"*

Remark

*Learning and teaching and education occur between the **complementary poles work and play** - like research between **applied and basic science** - and the synergetic combination can lead to a higher dimension - an "in-between", where for example earnest play and playful earnestness can no longer be distinguished, where excellence for the sake of excellence is at home and reconciles basic science with applied science, where spirit and senses get reconciled by music, and where poetic, viewing, prophetic, mystic, and alert, questioning thinking is at home and influences education.*

4. Four major different societies

It should be mentioned that in our societies of course there are also considerable chances for negative synergetic processes and effects, leading to steps backwards, regressions, higher risks and sometimes even to destruction, catastrophes and wars. To avoid or at least reduce these risks we must strive for "*true*" *interdisciplinary and intercultural cooperation*. True means in this context *to use the common* and not only to (rationally) tolerate the others and their differences (as well as the otherness in ourselves), but to *recognize them* (and it) and to try to synergistically combine ("putting away") both as mentioned above. Especially this "putting away" of the complementarity of the various cultures will "inspire" the most significant innovations. True further should mean to start a friendly, motivated and thorough teamwork with cooperative learning and teaching possibilities, enhanced through the support of a "healthy" middle class and through intergenerational cooperation.

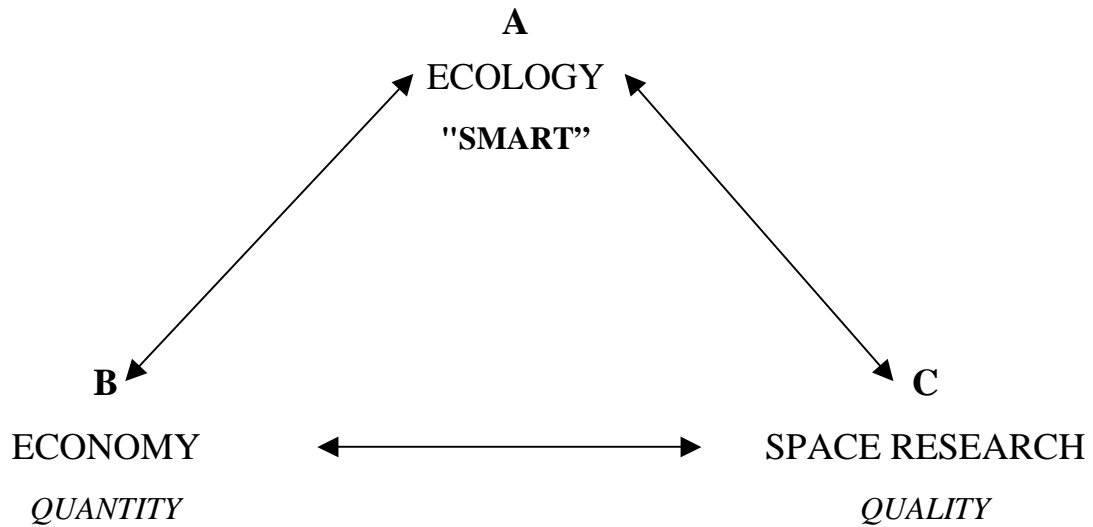
A necessity that in our societies evolutionary (biocybernetic controlled) processes - comprising competition and symbiosis - can sustain and/or dominate the "**velociferic**" destructive processes is, that we recognize the need for cultural, i.e. economic, ecological and technical, **diversity** (variety) and that we preserve it, - with the help of "catalysts", especially

in so called "patchwork" societies. Today very different societies exist in theory and practice. The major ones are:

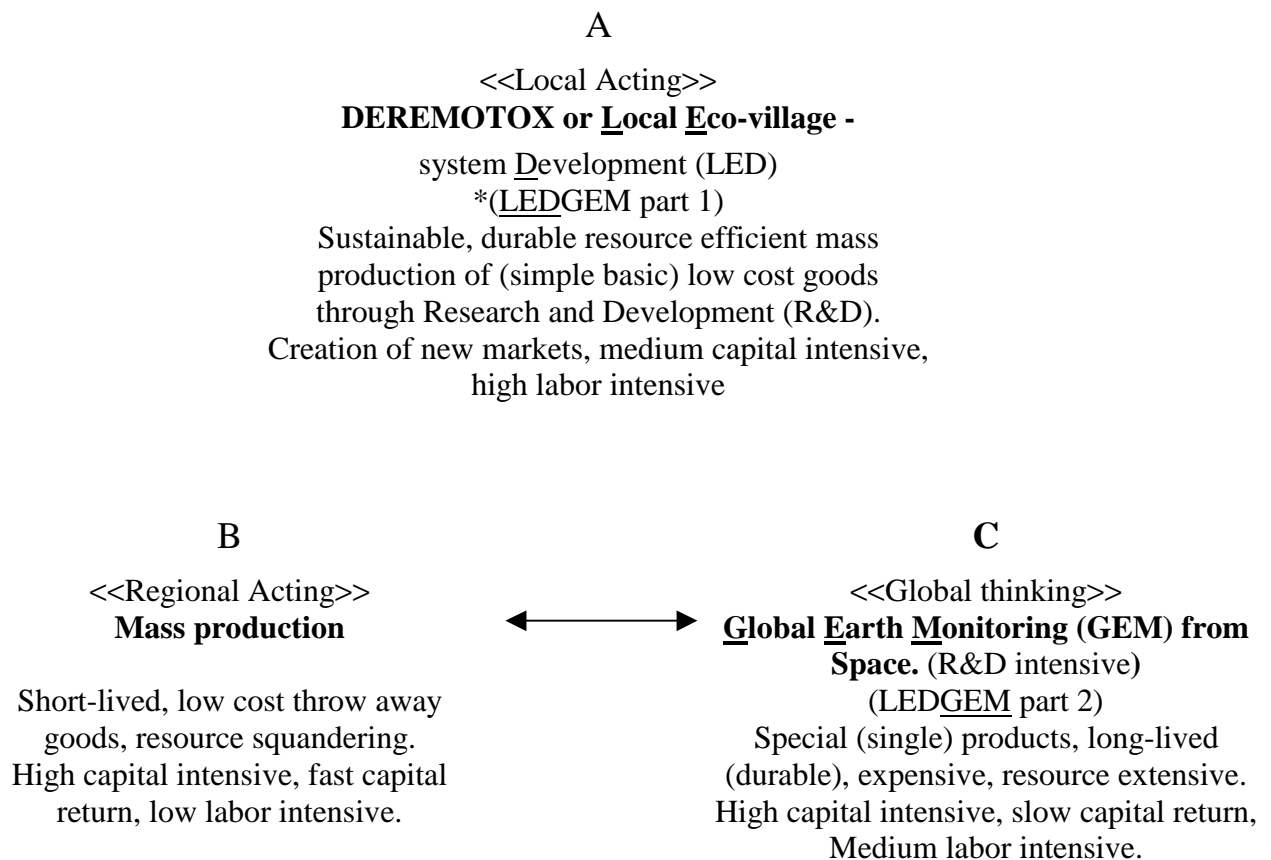
- the optimistic theory influenced by Charles Fourier (1772 – 1830), which strives, e.g. for an "inclusive society" and emphasizes the postindustrial and postnational (states), approaching the so called second **modernity**.
- the pessimistic theory influenced by Bernhard Mandeville (1714), which can be briefly characterized through the statement: " Be afraid of your neighbor as yourself" (Opposite to: "Love thy neighbor as thyself").
- the new "Gaia-hypothesis" which states: "We get what we deserve".
- They are complemented by the so called "Brazilianisation" and the opposite, the feudalistic oriental market economy.

In any case the time for national states - not for nations in the original sense - in the original 200 years old (European) sense runs out. The author has stated this already in 1991 in context with the Jugoslawian war and it is even more confirmed through the present Kosovo war. However, we need a state to protect the law, which keeps the option open: "**Liberty (freedom) for all**". In supplementing I. Kant's famous three questions: "*What can I know?, What can I expect?, What have I to believe?*", we have to ask also the question: **What shall we do?**

Figure 1 Modern production determining factors and production characteristics.

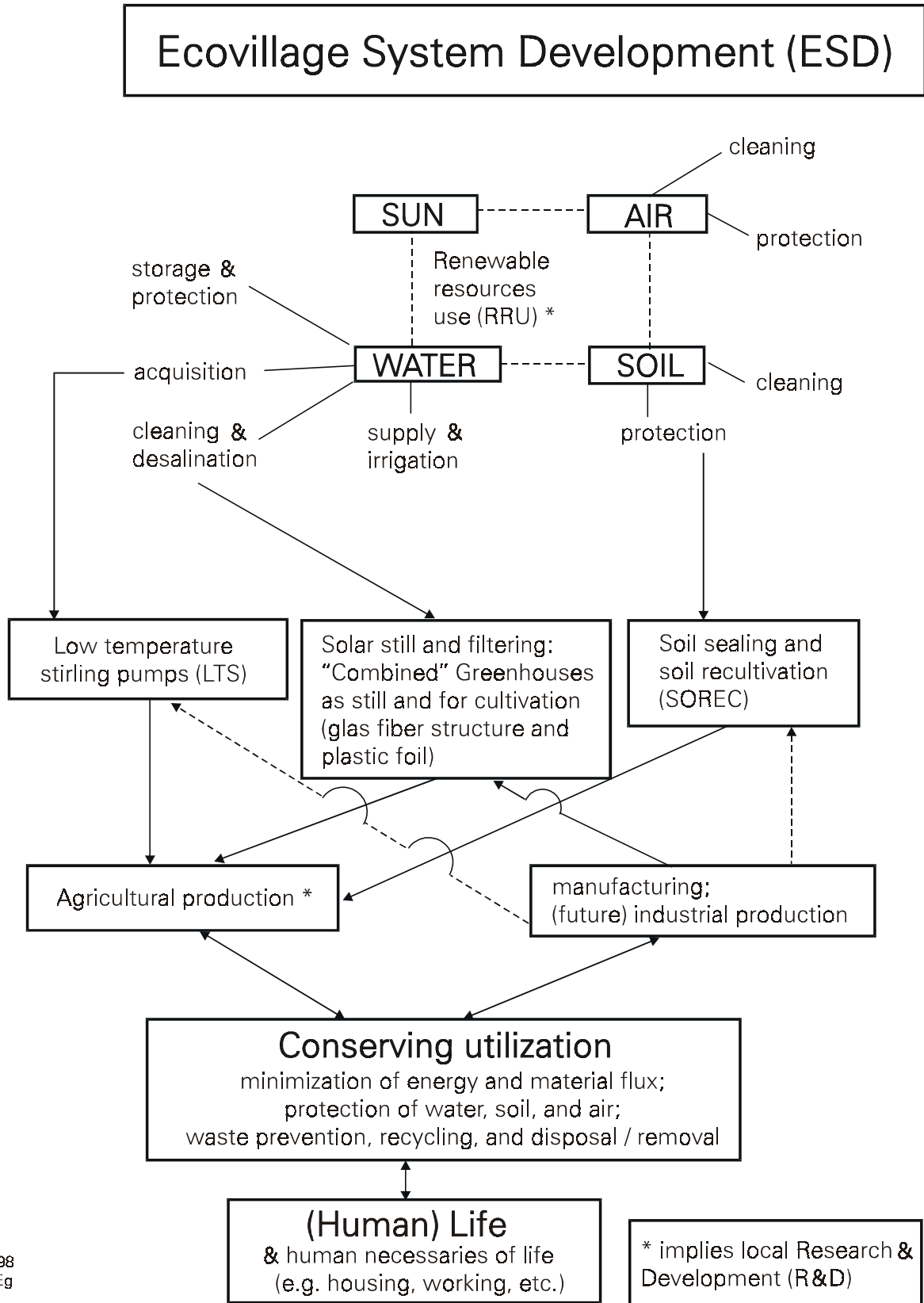


Example for fig. 1



*LEDGEM: Local Eco-village System Development and Global Environmental Monitoring (G. K. Hartmann, June 1998).

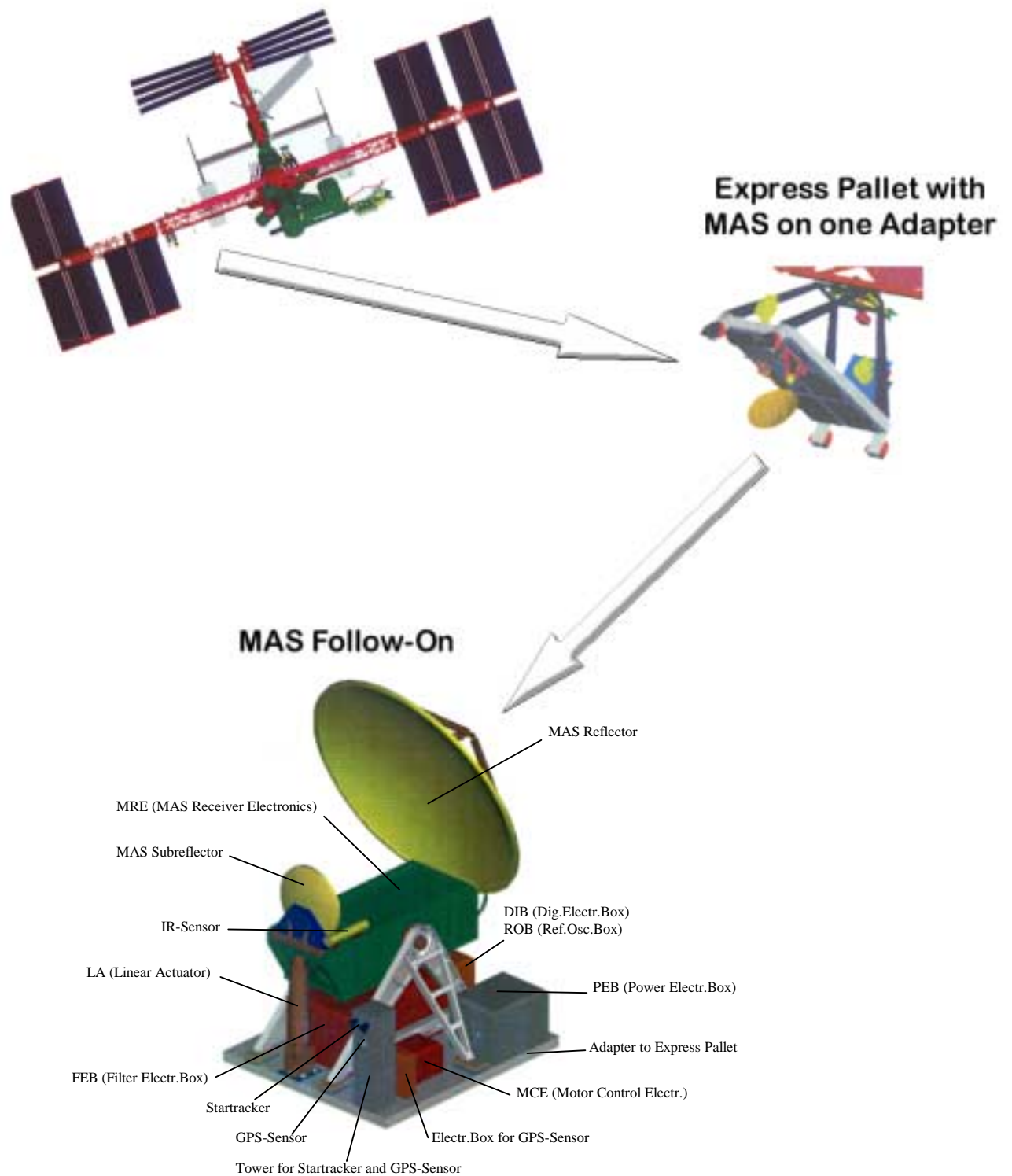
Fig. 2



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Fig. 3

MAS Follow-On for International Space Station ALPHA (ISSA)



Scientific Curriculum

Gerd Karlheinz Hartmann, born in 1937 in Eschwege, Germany, studied physics from 1957 to 1964 at the Georg-August-University in Göttingen, where he received his PhD. in 1967. Since 1965 he has worked as a scientist at the Max-Planck-Institut für Aeronomie, D-37191 Katlenburg-Lindau. For over ten years he concentrated his activities on studying the upper atmosphere using satellite (radio) beacon signals.

Since 1967 he has been dealing also with general and specialized information and documentation problems, from the viewpoint of large volumes of time dependent and space dependent data, especially of the type collected in his research projects. At present he works as a consultant on several national and international committees and holds lectures and seminars throughout Europe, and especially in the USA., in Argentina, and Chile, countries he has often visited in the course of his scientific projects.

From 1975 to 1978 he was the provisional director of a division of the institute, the Institute for Long-term Control of Geophysical Environmental Conditions (ILKGU).

Since 1979 his main area of specialization has been studying the lower atmosphere by means of microwave radiometry. He is the Principal Investigator of the Millimeter Wave Atmospheric Sounder (MAS) experiment which as a joint enterprise of Germany, Switzerland, and the USA has been flown as core payload of the NASA ATLAS (Atmospheric Laboratory for Applications and Science) Space Shuttle Missions (ATLAS-1 (1992), ATLAS-2 (1993), ATLAS-3 (1994); http://www.mpae.gwdg.de/mpae_projects/MAS/

Since 1980 he is "consultant" for information problems of the Institute of Intercultural Cooperation/Intercultural Research" (ICC/IIR: Heidelberg/Zürich/Pernegg). In the 80ties he travelled on behalf of that institute to India and Asia, especially for discussing his concept of the (intercultural) information system OCIR/VIGRODOS. He participated in and contributed to international conferences on problems of intercultural understanding and cooperation.

1986 he became guest professor and guest lecturer for filter and information theory at the University of Mendoza, Argentina. This task was extended in 1988, now also including problems of conserving utilization of the environment (sustainable development). In this context he is the international coordinator of the environmental program PRIDEMA started by the University of Mendoza (UM) in 1988.

1991 he became full professor at the engineering faculty of UM for "remote sensing for a conserving utilization of the environment" (sustainable development) and also "external scientific director of the institute for environmental studies (IEMA) of UM. In December 1991 he received the Dr. Luis Federico Leloir Award for international cooperation with Argentina in the domain of environmental research from the Argentinean minister for Science and Technology, Prof. Dr. R.F. Matera.

Since 1995 he works on the "value added validation" of remote sensing data from the Earth's atmosphere and he was manager of an international experiment proposal for the investigation of the MARS atmosphere - in context with the MARS EXPRESS Mission of the European Space Agency (ESA) - , till it was cancelled because of funding problems in summer 1999.

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