PRIORITY 2

INFORMATION SOCIETY TECHNOLOGIES (IST)

REVIEW REPORT

51136 HYCON

Project full title: **HYbrid CONtrol: Taming Heterogeneity and Complexity of Networked Embedded Systems**

Review no. 2 covering project month 1 to 12

Contract start date: 15th of September 2004

Contract end date: 15th of September 2008

Review dates: 5th 6th of October 2005

Review location: 33, avenue de Beaulieu, Brussels

Project Officer:	Rolf Riemenschneider	
Reviewers:	Peter Caines	peterc@cim.mcgill.ca
	Holger Karl	holger.karl@uni-paderborn.de
	Gabriel Leen	gabriel.leen@ul.ie
	Véronique Pevtschin	v.pevtschin@alum.mit.edu

Keywords:

Report number:

Report classification:

Report version:

Revision 1.06_final

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

The HYCON project is a Network of Excellence (NoE), funded for a duration of four years starting on 15th of September 2004. The total EC contribution is 4.6 M€, with the first 18 months period accounting for 2.1 M€.

The period under review covers the first 12 months of the project, and was aimed at monitoring the progress of work. This annual review provided a milestone in order to : (i) evaluate the quality of the information provided, (ii) to judge on any deviation and delays , and (iii) to resources that have been allocated during the first year. In addition, the work programme covering the next 18 months has been negotiated to include adaptations where appropriate.

The overall objective of HYCON is to integrate European research in "hybrid" control (i.e., systems & models with discrete and continuous aspects). This objective is structured into scientific and technological integration (coordinating fragmented European research & developing a research infrastructure), achievement of a durable integration mechanism through the establishment of a sustainable European Institute of Hybrid Systems, and overall spreading of excellence.

Major achievements are:

- Good general strategy to provide results to industry;
- Good overview of many legal issues (esp. pertaining to the intended institute and to IPR);
- Advances in dissemination and visibility.

Areas for improvement have been identified as:

- In some areas, level of achievement is difficult to assess – e.g., how successful was the automotive workshop?
- The EIHS has been delayed and provided information needs further analysis.
- Web site has improved significantly already, but does not constitute THE SITE of entry for all HYCON related activities (e.g. why different URLs for public and restricted access? Improve visibility of links on the web – change colours, clarify whether the list of publications is done within the HYCON project or just by the consortium members in general, provide some missing links – e.g. from WP2 to the online benchmarking questionnaire) – see Rec.10.
- There are minor deviations from the work plan.

The overall conclusion of the review meeting is that:

- The project is progressing well at technical and integration level.
- The recommendations of the first review have been seriously taken on board. The project has improved significantly in terms of deliverables' content, coherence, and relevance.
- The project objectives are still valid and the consortium is closely following the work plan.
- The reviewers support the continuation of HYCON. Remedial actions are not needed. The consortium should go ahead under due observation of the recommendations of the review as outlined in Chapter 9.
- Reviewers are confident about the scientific expertise and level of commitment of the project participants.

- Reviewers have made a number of recommendations and propose that these recommendations be implemented and verified prior to the 19th month milestone.
- Reviewers have agreed to the proposed work plan for the next 18 month provided that the changes that are outlined in Chapter 9 are duly implemented.

2 ORGANISATION AND LOGISTICS

The review was held in Brussels, at Commission premises. All partners required for this second review meeting were present.

The presentations were of excellent quality, very clear and informative. The consortium was very cooperative and open-minded to expert's questions and recommendations. The discussion was open and dynamic; the consortium members fully answered all the questions which were posed to them.

3 PROJECT MANAGEMENT

The quality of the project management is high; since the last review date it had the following main goals:

- *Improve the cooperation within and the operational conditions of the network*

  This issue seems to have been well implemented.

- *Ensure the implementation of integration aspects of the network*

  The integration of the network seems to be progressing well.

- *Improve the quality of operational tasks (including single presentation templates at reviews, timely delivery of submitted deliverables, shorter and more focused progress reports).*

  While this aspect has considerably improved compared to the first review, there are still a few aspects that require further attention.

  Similar to the first review, a considerable number of deliverables arrived late and consequently there was not enough time to carefully assess the content before the review. As a general remark, the management should make sure that the experts have sufficient time to review the deliverables, given the large volume of material involved, a minimum of 3-4 weeks before the review would be appropriate.

  Along the same lines, the extent of the deliverables is very large, partially owing to them not being well focused; some of the deliverables contain long stretches of needless background material, some contain long lists of facts but fail to properly analyse these facts. Here, a better focus would often be desirable, allowing the consortium to trim down on the amount of text produced. Moreover, a succinct "executive summary", putting each deliverable quickly into focus, summarizing the problem at hand at the contribution to this problem, for each deliverable would be highly appreciated (the level of abstraction provided by the current deliverable abstracts is not very useful).

  In addition to planned deliverables, the project also contains milestones that represent *decision points* of HYCON. These milestones are important as they impact future activities of HYCON. Therefore, these milestones should not only be listed as "milestone achieved", but a brief documentation detailing the decision taken at a given milestone should be provided. This constitutes necessary information to assess the progress of the project (see Rec.7).

As suggested in the previous review a number of current FP6 projects have been contacted, specifically: CEmACS, SICONOS, HYBRIDGE, RECSTS, CC, ARTIST2, AMETIST, RUNES (where some of the consortium members also participate themselves), as well as CTS. In this respect, the recommendation of the last review has been implemented. The reviewers encourage the NoE to maintain and expand such contacts, for instance by systematically inviting the communications, computer science and robotics communities to participate in sessions of workshops organized by the NoE when this would be relevant to the research activity.

Management issues concerning the individual work packages will be discussed in the relevant subsections below.

4 DELIVERABLES

The following deliverables were due at month 12.

Deliverable 1.1.1

This is a deliverable that was accepted in the previous review with a recommendation to extend. The current version has increased the mission statement satisfactorily and added a section on "Successes and Failures" at the end (section numbered as 4 should be highlighted as a title). The addition of content is appropriate.

Deliverable 1.1.2

This deliverable provides an overview of the possible funding sources for the EIHS. It is clear and concise, but with a major limitation, in that for every identified funding source, the potential of this funding being accessible and the timing of these sources is not provided (what is the duration of each source? How are these sources accessed; through calls? Does the consortium have a privileged access / a prior experience etc. in using these sources?)

In this respect, this deliverable provides a *list*, but not an *analysis*, and the added value of a deliverable is in how it contributes to the overall goal. The analysis should be contained in the deliverable, and should not be left to the reader to derive. It is also recommended to summarise this analysis in a tabular format, if possible, so that the options may be succinctly presented and easily compared. The deliverable is accepted as it is provided that the missing analysis will be included in future deliverables that are due in the next period (see also Rec.2).

Deliverable 1.2.1

This deliverable is clear and concise regarding the various legal entities that can be envisaged for the EIHS.

It ends with a questionnaire for each partner – however, the questionnaire process should be sent together with the proposed business plan linked to each model, as without that the exercise is mainly set at the legal level without taking into account the exploitation level.

The main question is whether some of these legal collaboration structures cannot be envisaged due to partners not being able to commit to these. This issue is presented as an open issue ("partners should check…" on page 6, 8 etc) and the "checking process" could be very time consuming at the level of each legal department if time pressure is not put on this process.

Did all partners already investigate in which type of legal structure they can participate in?

It is not fully clear how the final decisions will be arrived at, or whether all of these decisions will be offloaded to the manager (which might not be the optimal approach).

What seems to missing is a joint discussion of the legal structure and the funding sources – which funding sources are to which degree and in which form available to each legal structure. Similarly, the location discussion for EIHS should be integrated as well.

An additional aspect that might be worthwhile considering in the future is the issue of (limited) warranty of results achieved by the EIHS, depending also on the source of funding for which research should be undertaken.

The deliverable is accepted as it is provided that any remaining decisions will be made transparent to the experts.

Deliverable 1.3.1

This deliverable is clear and concise.

It is unclear why the duration criteria on page 13 only foresees 2 years (as a MUST criterion) as the success criteria of EIHS developed in deliverable 1.1.1. are to be analysed after 5 years.

Deliverable 1.3.2

This deliverable lists the various infrastructure elements available at each partner. It is complete, but lacks the following information:

- not all numerical information provided;
- some partners only list workstations available, but how many?
- meeting rooms – no information provided as to the size of each meeting room.

As a suggestion, a section should be made available on the Web site that includes meeting room reservations if these are available to HYCON.

This is a good start at creating an inventory of available resources, but not totally complete. The missing information is something that the consortium shall need to move to the next step and make this deliverable useful, rather than just delivered to reviewers.

Most importantly, this deliverable is explicitly intended to be useful for the consortium's own work. If the list and the information contained therein seems sufficient to the consortium work, then this is acceptable to the reviewers as well.

Deliverable 1.4.1

This deliverable lists some statutes of other "associations" that could be used for the EIHS. Similar to the deliverable on EIHS structure, this one does not really provide an analysis of these statues, but simply lists them. Therefore, the practical usefulness of this deliverable is limited.

It is unclear why these statutes have been selected (versus other existing ones)? Are these more appropriate, closer to the goals of EIHS? What are the drawbacks of one versus the other? Which ones would be best for EIHS?

Similarly to D1.1.2, this is a list of items, but lacks analysis of their commonalities and differences with EIHS.

The deliverable is accepted as it is provided that the recommendations given in Chp.5.1 and Chp.9 are closely followed.

Deliverable 1.7.1

This deliverable summarises the 1st HYCON summer school. The fact that half the participants came from non-HYCON organisations is very positive. Additionally, the inclusion of an evaluation questionnaire, as a feedback instrument, was viewed as a very positive initiative.

The pdf files of the presentations of the summer school should be made available at an obvious location, e.g., on the Web site of the summer school and on the main HYCON Website as well.

Deliverable 2.1.2

This deliverable describes the benchmarking approach used and links back to the online HYCON tool.

No specific comments on this deliverable which is clear and well written.

The on-line questionnaire is too difficult to find, and requires going on the restricted site, choosing the Documents section. Missing direct link from the WP2 work package itself, for instance by clicking on “Performance Evaluation Platform”?

Shall this on-line questionnaire be provided on the public HYCON Web site (or is it already there and was overlooked by the reviewers)?

Deliverable 3.2.1

This deliverable compares available tools and interchange formats, and it is mainly based on an existing report (from the Columbus project). Re-using existing work rather than doing work that already exists is positive – however, it is unclear how much work has been done that actually is HYCON-specific. For instance, section 4 on the interchange formats states problems that arise from some choices, but not how HYCON can approach these or whether these shall be overcome – or that whatever HYCON does, these limitations will still exist.

Deliverable 3.2.2

This deliverable is very clear, has a good introduction and presents a “strategy for demonstrator” that clearly indicates the target audience etc.

The problem concerning software licensing patterns in section 3.2 is central to the success of this deliverable, \ but the plans on how to follow-up on this issue are unclear. One suggestion is that it might be possible for free “for demonstration purpose” licenses to be negotiated with each commercial vendor, while emphasizing that the site in question is also serving their interests as first level demonstrators.

Does the comparison in D3.2.1 link to the Web site proposed in D3.2.2.? (refer to “the matrix proposed to visitors”). In other words, will the comparison conclusion be displayed on the Web site?

Deliverable 3.3.1

This deliverable is clear. As pointed out above, a high-level overview how this and the following deliverable relate to each other and to the "big picture" would have been helpful – this only became fully clear during the review presentations.

Deliverable 3.4.1

This deliverable provides the evolution made to provide tool interoperability through a one-step approach that is more efficient. The legal investigation has been done, and the consequences ("limitations to Europe for the HYCON potential") are reasonable.

This deliverable is very clear, well explained, and well argued.

Does the change in approach impact the duration of WP3, or the amount of resources?

At the level of cost, how is the "legal advice" reflected in the costs? This cost should be part of the project as it is beneficial to HYCON.

Deliverable 3.5.1

This deliverable provides the comparison between available approaches for co-simulation.

The executive summary should be re-written (does not relate to this deliverable).

The deliverable is accepted with an addendum requested.

Deliverable 4.a.1.1

This deliverable outlines the presentations, discussions and conclusions of the first meeting of the HYCON participants who are focusing on the utilisation of hybrid control techniques for the production, distribution and conversion of electrical energy. Areas of focus, responsibilities, and the proposed benchmark examples, methods and tools have been outlined. The document is logically constructed, succinct and complete.

Deliverable 4.a.2.1

This deliverable is complete and highlights the need for WP4 to link to the other work packages, and to the outside world. It shows an improvement in the collaboration between WP4 and the planned dissemination work over the next years.

Deliverable 4.b.2.2

This deliverable describes the current work already done on four benchmarks, and concludes with a presentation of the next evolution of the work to be done (area: industrial processes).

Based on the information givev, it remains unclear how this work is linked to other work packages, i.e. WP2 and WP6. Have these benchmarks also been used as inputs to test the benchmarking questionnaires done in 2.1.2.? To which extend have case studies evolved from tasks in WP6 ?

Deliverables 4.c.1.1, 4c1.2 and 4c1.3

These deliverables describe the current work already done on models in the automotive area. No specific questions, apart from interest of linking back the benchmarks with 2.1.2.

Deliverable 4.c.3.1

This deliverable uses two examples to analyse the advantages of using hybrid system design approaches in the automotive area. It is clear and well described – the final conclusion that will be reached after the work is extended in the next phase of HYCON will validate the work already done.

No specific comment.

Deliverable 4.c.4.1

This deliverable summarises the first HYCON automotive Workshop.

The link proposed to register does not work and no information other than the announcement of the Workshop could be found on the Web. The link from the HYCON Web site does not work either.

Major concern is that the registration etc should be handled from the HYCON Web site and not from the partner Web site – it is really important to build the HYCON "constituency" approach – and this has not yet been done.

Compared to deliverable 1.7.1. (on the Siena workshop) , this deliverable provides the content of the workshop and the list of participants. However, it lacks analysis – was the workshop well perceived, should it be improved etc – information that is presented in the 1.7.1. deliverable.

A major concern is that it is difficult to assess how positive and how useful this workshop was. Participants were mainly from the existing HYCON constituency. Was this a pre-requisite for attendance or was the workshop open to other organisations? During the review, it was mentioned that a questionnaires will be distributed to the participants for future workshop. In this way, this would definitely contribute to the assessment and quality control of such workshops. In the preface of this deliverable it states that: "The aim of the workshop was identifying challenges and opportunities for hybrid systems in automotive design. In particular, the following topics were discussed: industrial trends and concerns; methodologies, flows and tools; theoretical open problems." However, without documentation it is difficult to assess whether this aim was achieved (see Rec.6)

The deliverable is accepted with qualifications. The consortium is asked to describe how the outcome of the workshop has been evaluated and to provide documentation of this assessment by preparing an addendum to D4c.4.1.

Deliverables 4.d.1.1. / 4.d.1.2.

These deliverables are the first in the series of deliverables linked to the application of Hybrid Systems in wireless communication. They are essentially well prepared and structured, with clear links to other work packages. Some of the material, however, could have been presented more concisely. Ideally, these two deliverables should have already made clear the precise hybrid control

problems that will be addressed in this context, similar to the work done in WP 4b. This has been extensively discussed at the review meeting.

Work involves clear links to the Industrial Advisory Board.

Deliverable 5.4.4

This deliverable points to the published book. However, if the book constitutes the deliverable, it can be accepted if the book is made available to the reviewers, either on line or by temporarily lending a copy. Alternatively, the deliverable should contain the executive summary of the book. The deliverable is accepted with qualifications. The deliverable needs to be resubmitted.

Deliverable 6.1.1

This deliverable is a very good first step for the legal environment in which collaboration of NoE partners can take place.

It is clear and concise.

Suggestion is to analyse whether all the legal work should be centralised here, as there is some legal work done elsewhere (work on Statutes, work on software licensing problems for the HYCON demonstrator). The issue is to ensure that it might be useful for all the issues related to legal issues to have one single entry point to remove any redundancies.

Deliverable 6.1.2

This deliverable presents a list of the industrial partners' involvement in HYCON. It is very clearly presented, and the format is well defined. It is recommended that HYCON further encourage its industrial partners to consider internship for students and researchers, as this mechanism

Some questions arose concerning the missing description of Pirelli's role. (Why is the Pirelli page empty?). Also, some partners are clearly involved as contributors to HYCON, others are more passive with a role that can be described as "recipients of information". Shall this situation evolve?

Deliverable 6.2.1

This is a technical deliverable, clear and well written. No specific comments.

Deliverable 7.3.1 and 7.3.2

These deliverables relate to administrative management of HYCON. These deliverables are clear and well written. No specific comments other than checking that the Word files are provided with all changes accepted (minor point).

Deliverables mention that document templates are available on the HYCON Web site, however, the reviewers did not find them (looked under the Documents area).

Deliverable 8.1.1

This is a dissemination deliverable, listing all dissemination activities during the period. The dissemination activities are very positive, and HYCON is very active. The only comment is that this deliverable includes information also provided in other workshop deliverables (workshops, book etc). Suggestion would be to take out all future deliverables that describe a single workshop and retain only a centralised dissemination deliverable using the format of 8.1.1.

Deliverable 8.5.1

This deliverable summarises the links to other on-going activities funded by the European Union. The deliverable is well structured, it is clear and concise.

Deliverable 8.6.1

The report represents a deliverable that points to possible developments beyond the scope and horizon of HYCON. No specific comments.

Progress report

The progress report is very well structured and concise and is sections are clearly written. This version of the deliverable was very useful for the review process, with an appropriate level of detail. The NoE would be strongly encouraged to maintain this format for progress reports and apply a similar philosophy to many of the other deliverables.

General comments

As a general comment, the reviewers would like to point out that deliverables should be brief, concise and to the point, focusing on the technical/management question at hand, rather than repeating background material (e.g., motivation on hybrid control or textbook material on networking). Also, when providing updated versions of deliverables, it will be highly welcome to clearly indicate updated areas.

5 WORKPLAN AND RESOURCES

Compared to the state of the last review, the different workpackages appear to be better aligned and integrated with each other. This removes a major worry of the last review recommendation. Nevertheless, some workpackages require improved focusing. The areas of improvement are detailed below.

The workplan has been closely followed and has been modified where appropriate. The available resources have been efficiently used and have been supplemented to a considerable degree through external sources. In general terms, the results achieved after the first year are in line with efforts allocated and documented in the progress report.

5.1. Workpackage 1: Creation of the European Institute for Hybrid Systems EIHS

The Hybrid Systems summer school was very well organised and promoted. It was considered to be a big success with the participation of 112 students, of which 5 were from industry, while 61 of the 112 students were from organisations not affiliated with HYCON. This clearly showed that this HYCON activity went well beyond the consortium, while feedback illustrates that the material presented has been well received.

In addition to this, the creation of a PhD curriculum in Hybrid Systems for the EIHS International Curriculum Option (ICO) for doctoral studies in Hybrid Systems and the support received from 14 Universities for this program is also considered a significant achievement. However, the question arose as to who will actually formulate and approve the curriculum. Our recommendation is that an Academic Curriculum Committee is constituted in order to formulate, approve, and manage the ICO.

One of the main objectives of WP1 is the foundation of a European Institute on Hybrid Systems (EIHS). During the first year, the consortium has started to work on its vision, definition, legal structure, and governance though no decision actually has been taken.

Concerning both the location and the legal structure of the EIHS more analysis is required as follows:

Location: A detailed evaluation of the merits and drawbacks of the five alternative locations is needed by M13 (i.e. November, 2005) in order that a decision on location may be made as planned by M15 (January, 2006). This will permit the position of manager to be advertised by M16 (February, 2006), with the town and region of residence unambiguously specified. (We note that two distinct planned dates for advertising the position of Manager are given in Deliverable WP1 (Planned Activities WP1: M 13 & M 30).

Legal Structure: Three possible legal structures have been identified, namely: (i) the EEIG Model, (ii) the Association Model and (iii) the Company Model. The experts strongly recommend that a legal structure for the EIHS chosen by the 1st of February, 2006, at the same time as the location.

Issues relating to the nature and role description of the EIHS manager were discussed in detail. The reviewers expressed scepticism that a person combining the set of qualities described in the current statement D1.5.1: Ideal Profile of the Manager(s) could be found. One deficiency in the job specification is that the duration of the position is not defined. Moreover, the reviewers foresee a possible conflict between the expressed need for an early-career manager with research qualifications and the length of tenure required in this position to ensure continuity in the operation

of the EIHS. The experts recommend that the decision on the manager should be taken not later than month 18 (see Rec.2).

The question of the management of research direction of the EIHS was addressed. The reviewers observed that in WP1 no clear definition is given as to who will perform this function and how it will be performed. In response to this, the reviewers proposed that a Research Direction and Management

Committee should be defined and established for the EIHS. A point was also raised regarding the naming of the new institute. It was generally felt that the HYCON NoE should carefully consider alternative names for the new institution, since having “hybrid systems” as a part of the institution name may inadvertently limit the scope and the possible duration of the institution in the event that the explicit term “hybrid systems” should fall out of vogue. As outlined in the Deliverable 1.1.1, section 3.1: “A specific mission of the EIHS will be to redefine the scientific scope of its investigation field adaptively, since the evolution of the scientific basis of hybrid systems studies together with the associated technologies will confront the Institute with new scenarios and new opportunities. What is today defined as “Hybrid Control” might no longer be at the core of the Institute's activities in the future”; consequently the naming of the Institute needs to be carefully considered.
As part of the HYCON marketing activity, the NoE was encouraged to instantiate links to the HYCON web site from as many other related sites as possible.

5.2. Workpackage 2: Performance Evaluation Platform (Benchmarking)

The reviewers felt that this work package was progressing successfully as planned.

5.3. Workpackage 3: Tool Integration

The reviewers thought that the Tool Integration task was progressing as planned; they were satisfied with the accomplishments reported and they wished to contribute the following remarks and suggestions:

- In order to maximize the return for the effort invested in this work package it is suggested that the integrated HYCON Tool Kit be applied to a selected set of the Case Studies.
- A detailed, annotated, diagram representation of the tool architecture and the data flow path structure would be helpful. In addition to this, the scope of the functionality actually integrated and a detailed description of individual tools outputs and functionality both at an individual and at an integrated level would be of value.
- It is suggested that an interface specification for the Tool Integration framework be made available. This would afford the opportunity for tool creators to design their tools so as to be compatible with the Tool Integration framework.
- Some demonstration of the integration of any two of the major tools which are important for the application domains would be welcome at the next review meeting.

The reviewers appreciated the flexibility that was demonstrated by the fact that the workplan adopted at the six month review had not been obediently followed but that it had been adapted in response to the fact that activity D 3.4.2 had been subsumed under D 3.5.

The reviewers also raised a point relating to the maintenance of the Tool Integration framework, and who would be charged with this task in the long term. Additionally, clarification was sought on what approach would be adopted to maintain the Tool Integration framework compatible with future revisions/updates of the tools which were being integrated.

5.4. Workpackage 4: General Remarks

The reviewers were satisfied with most elements of this workpackage in terms of the quality, relevance, and depth of the contributions. The reviewers would like to add some general remarks as a preface to the detailed comments for each sub-workpackage given below. The following were thought to be of value:

(a) A clarification that every tool has been used on something – even if it has failed! (Negative examples would be most valuable, as these will highlight research opportunities for the broader hybrid systems research community.)

(b) It has to be shown that the application domains actually use some of the tools described / integrated in WP 3.

(c) It has to be made clear that some or all of the topics have been addressed by at least two different tools and an evaluation of the results provided – or else, the effort expended will have been wasted.

(d) A matrix of problems and applied tools should be one of the end results – although this may be a premature expectation at the current time it should definitely be available prior to the end of the project (see Rec.5).

(e) The distinct *hybrid* nature of the case studies and problems were not always sufficiently highlighted. An improvement here would assist the NoE in its marketing activities.

(f) In the area under consideration by the NoE, hybrid theory seems to be less advanced than application of hybrid techniques and tools; in general, the reviewers believe there is a significant theory-practice gap in hybrid control with theory lagging behind practice. Whenever possible, it would be very welcome for the development of hybrid control theory and engineering if the gaps were identified and highlighted. Addressing these gaps will eventually close the theory–practice loop in many important areas.

(g) Some of the problems/case studies did not seem to have a clear definition of the actual research / control problems which have been encountered. Activities should be more focused and a clear preference should be given to a limited number of case studies. 3-5 case studies should be selected and examined in detail, i.e. considering tool application, tool interoperability, validation and the integration of new control algorithms (see Rec.2). One outcome of the project should be to allow for some first cut judgement of the applicability of a tool platform and of the effort required for tool integration. This should be clarified.

Workpackage 4a: Energy Management

Mainly driven by industrial companies, this work package demonstrates very good interaction with relevant industrial partners. The work package clearly identifies issues related to handling the complexity of the problems using the set of available tools.

- However, to ensure that the results obtained from applying these tools are representative, objective and reproducible, the reviewers recommend to ensure that the tools are validated by persons other than those who have developed the tools.

Workpackage 4b: Industrial Control

- The reviewers appreciate the considerable amount of work that has gone into the definition and description of the individual case studies and the resulting level of detail of the modelling and system specification. The experts would encourage a similar level of effort be expended in the remaining WPs 4x – this level of detail seems to genuinely reflect the complex, industrial nature of hybrid control problems.
- The reviewers appreciate the fact that a selection of *three* main case studies has been made. However, there is some concern that the amount of available man power might be less than actually required. On the other hand, if the consortium deems it necessary to maintain a longer list of case studies (e.g. out of considerations for industrial dissemination), this is also an acceptable decision. The consortium has to consider this potential problem and make a motivated decision about the resource allocation issue.

Workpackage 4c: Automotive

- The reviewers appreciated the fact that the relevant economic aspects of the industrial control problems under consideration were mentioned, e.g., the productivity and production costs.
- The reviewers feel there is a need to document outcomes of meetings like the 1st HYCON automotive workshop. In general, documentation on industrial feedback was essentially absent and should be improved in the future (if only for project-internal networking activities) – see Rec.6.
- As a practical suggestion, for workshops like the one above, the introduction of "*discussants*"[†] for papers (e.g. pairing up academic papers with an industrial commentator and vice versa) should be considered. The experts would definitely encourage the adoption of such a procedure.
- The level of industrial interaction is very laudable.
- There are many projects in this workpackage, all of which are very relevant and have strong links to industry. The reviewers express some concern relating to the amount of available man power and the administration/coordination overhead. The workpackage leader was encouraged to streamline the administrational overhead where possible.

Workpackage 4d: Networked Control

- The two selected scenarios constitute a reasonable starting point to define actual hybrid control problems in this important and vibrant area. Hence, it seems necessary to make rapid

[†] *Disscussants* - As a practical suggestion, for workshops like the one above, consider having a member(s) of the industrial community formally discuss the academic paper presented and similarly an academic person or panel to formally discuss and comment on industrial papers.

progress to a specific, formal definition of these problems or parameterized classes of problems (compare, e.g., the problem descriptions in WP 4b). Based on such a description, the actual hybrid control problem should be formulated on a theoretical level as well as on an experimental level. Then, it should be clarified which control methods will be applied (principles as well as practical software, etc.). Ideally, this application of hybrid control will then lead to demonstrate an actual progress for the initial problem.

It seems necessary to provide these formal problem definitions as quickly as possible (see comments in Chp.7 and Rec.8).

5.5. Workpackage 5:

The results achieved by the workpackage so far seem to be on track towards an adequate solution to the problem. The work during the reporting period basically was split into 3 major activities: First the creation of a taxonomy and glossary of hybrid systems, here a first version of the taxonomy of hybrid systems was drafted according to the work plan while a further adaptation and discussion on extension is to be discussed in the following months.. Second, a technical infrastructure of an annotated bibliography has been set up.. The implementation of the SW infrastructure has progressed well, in particular it targeted a uniform SW framework including an online tool establishing a set of metadata, a virtual library tool, a database, a web-server etc. Third, the dissemination activities to spread excellence including the organisation of the HYCON summer school are being constructively pursued. The latter was held in high regard by the experts.

Major resources in WP5 are devoted to the implementation of the technical infrastructure of the annotated virtual bibliography. At this point of time, it was indicated that the consortium may not have the resources in software engineering and development necessary to fully implement and maintain this infrastructure (see also Chp.7).

5.6. Workpackage 6:

This workpackage progresses well. The 6-monthly appraisal of interaction with industrial partners is highly appreciated. The reviewers are looking forward to learn about the experiences of HYCON with the different levels of industrial membership.

6 USE AND DISSEMINATION

Exploitable knowledge and its use

The discussion about IPRs generated from this project has shown that the issue of “exploitable” knowledge is not a straightforward one for this type of project. The policies proposed by the project appear to be appropriate and acceptable.

Dissemination of knowledge

The work on dissemination of knowledge has improved; especially the web site, which is much better organized now and contributes to a consistent HYCON identity.

7 FUTURE WORK

The critical issue at the moment is the further planning of the workplan for the coming months M13-M30. The current proposal made by the consortium at the review meeting makes sense overall; however, the number of proposed deliverables and milestones seems very large though they have for the most part been well justified. Similarly, the nature of milestones and deliverables should be fine-tuned; some deliverables might actually be milestones and vice versa.

The new workplan therefore is accepted subject to the requirement of some minor modifications. It is recommended that an updated, streamlined version of the workplan should be prepared as soon as possible. Specifically, the following recommendations for changes have been made:

- WP1: New deliverables and milestones have been defined in WP1 paving the way towards the foundation of the new EIHS institute which were acceptable to the experts. As such, the most important one is the selection of the institute manager. This decision should be taken not later than m18. As a general remark, the experts should be notified upon any further deviation or delay in the schedule, in particular, in this work package.

- WP3: The work package intends to progress along the line of previous results achieved. As such, tool integration is concentrated on switched linear / piece-wise affine systems looking at related interchange formats, which is acceptable. No input from the stochastic (control and also data processing and statistical community) is currently being taken into account in the project to the extent that it deserves. While it is apparently intended that this should take place in the future, the experts believe this to be an important and relevant source of inputs that should not be neglected at this relatively early stage of the HYCON program. Activities which are aimed at including stochastic models and tools are strongly encouraged by the reviewers A first demonstrator of the tool platform should be ready by Aug. 2006.

- WP4C: It is of the utmost importance to assess and qualify the industrial involvement and contribution in the project because it seems that there are many companies that showed strong interest in the project. Due to limited resources available in the workpackage, it is necessary to give priorities to a limited number of case studies, i.e. 3-5 cases to which the HYCON tools could be applied. Also, it is suggested to define a matrix for those selected cases vs. tools with greater maturity and add a further deliverable.

- WP4D: The workpackage has been renamed and focus has been given to 2 case studies. Proposed future work should address these two case studies in greater detail. The envisaged testbeds and the extension to control of wireless, inhomogeneous networks were felt to be too broad. Similarly, the workshops planned by WP 4d should take into account the range of opportunities already provided by the networking community at large. It does not seem advisable to duplicate effort here.
  As a general remark, the level of maturity of existing tools and the necessity of the proposed work was not convincingly presented. The experts advise a restriction *to homogenous, wireless networks* and recommend that two case studies chosen in the first year should be worked out in detail. In this context, deliverables should be refined and milestone descriptions should be made explicit. Progress on this matter will be reviewed at the next midterm review after 18 months and if not more advanced, it might be appropriate for the consortium to consider reallocating resources towards application domains that tend to be more mature but less funded in the WP, e.g. WP4B (see Rec.8).

- WP5: Given the constraints explained by the workpackage leader of WP5, however, the experts would be in favour of a lightweight solution to the objectives of this workpackage, i.e. targeting a lightweight publication of a handbook instead of an online library which

require a ‘heavy’ infrastructure (decisions should be made e about the options discussed during the review, e.g., an edited volume as a basic “reader” on hybrid control). Consequently, it is recommended that resources be allocated away from WP5 and to reinforce other activities. Since tool integration is considered one of the core activities of the project one favourable option that has been identified by the experts is to strengthen tasks related to platform development and tool integration in WP3, for instance, by reinforcing software engineering activities (see Rec.12).

- WP8: The project will develop a number of servers, databases, experimental sites, etc. Who is going to maintain this IT infrastructure after the project? Which of them will be continuously available? Which will be passed on to the EIHS? Is there a clear policy or at least a clear plan? This issue should be taken into account at an early stage because it could potentially pose a risk for the project management but, in the future, this will be the key to durable maintenance, applicability and dissemination of HYCON result. This recommendation should be taken as input for the pending deliverable D8.2.2.
  Similarly, it is not completely clear whether the consortium is aware of relevant results from software engineering/modelling areas. Also, the visibility of the consortium results at these conferences seems to be rather low. The reviewers encourage the consortium to embrace these disciplines as well and to try to publish in these arenas as well (see Rec.9). In this context, the consortium is advised to continuously explore synergies and possible way for dissemination through collaboration with related projects (as mentioned in Chp.3).

8 ASSESSMENT OF OBJECTIVES

The objectives of the NoE HYCON are still relevant to the field and to industrial practise: this is the case for both the actual research work– in principle, assessing tools for hybrid control systems in different application areas – as well as for the integration work –ensuring that different tools are compared against each other and that, in general, the state of awareness of hybrid systems is raised in a wider audience .

In fact, the reviewers felt that a wider mandate for the project, including actual theoretical research, would have strengthened the outcome of the project even more. However, already at this early stage of the project, it became clear that considerable additional research effort, which is not directly funded by the project, is being expended and is contributing to the HYCON mission and objectives. As basic research on new algorithms and methods is not directly supported by the project contract, it is not appropriate to criticise the project for the lack of this type of work.

9 RECOMMENDATIONS

In addition to the detailed recommendations made in the previous sections, the general recommendations are listed below.

- **Recommendation 1:** The consortium is asked to continue and improve the focusing of some workpackages on the hybrid control aspects.

- **Recommendation 2:** Concerning the creation of the EIHS, the consortium is facing important decisions prior to the inauguration of the Institute. The information provided is concise but should be further analyzed, for instance the decision on the manager should not be postponed later than month 18 and any remaining decisions regarding the EIHS (e.g., legal aspects, business plan) should be clarified.

- **Recommendation 3:**. The following deliverables are accepted with qualifications: D3.5.1, D4c.4.1 and D5.4.4. Following the comments in the corresponding sections, the consortium is asked to provide more details and/or to revise the deliverable.

- **Recommendation 4:** The consortium should improve and clarify the links of all WPs, especially WP4x, to the Industrial Advisory Board.

- **Recommendation 5:** A matrix of problems and applied tools should be one of the end results of WP4 activities – although this may be a premature expectation at the current time it should definitely be available prior to the end of the project.

- **Recommendation 6:** The reviewers feel there is a need to document outcomes of meetings like the 1st HYCON automotive workshop. In general, documentation on industrial feedback was essentially absent and should be improved in the future.

- **Recommendation 7:** Milestones should not only be listed as "milestone achieved", but a brief documentation detailing the decision taken at a given milestone should be provided. This constitutes necessary information to assess the progress of the project.

- **Recommendation 8:** With respect to the future activities in WP4d, the experts advise a restriction *to homogenous, wireless networks* and recommend that two case studies chosen in the first year should be worked out in detail. Progress on this matter will be reviewed at the next midterm review after 18 months.

- **Recommendation 9:** The visibility of the consortium results at conferences outside the 'Hybrid Control' domain seems to be rather low. The reviewers encourage the consortium to embrace these disciplines as well and to try to increase awareness beyond the 'hybrid control' community.

- **Recommendation 10:** The consortium should improve on visibility and practicality of the website and the HYCON material, e.g., make slides from workshops/summer schools

available as quickly and as directly as possible; make this available in a uniform, easy to grasp manner on the website.

- **Recommendation11:** The scientific council seems to be biased towards the US (9 out of 13, 2 Europeans, 1 Canadian and no Japanese) – the reviewers encourage the consortium to reconsider this aspect.

- **Recommendation 12:** The consortium may consider the reallocation of resources taken from WP5 in order to reinforce the tool integration effort in WP3. The issue of durable maintenance, applicability and dissemination of HYCON results should be taken as input for the pending deliverable D8.2.2.

- **Recommendation 13:** The workplan for the next 18 months is generally accepted with some qualifications as outlined in Chp.7. The new workplan should be modified accordingly and amended to the contract by the end of October

10 REVIEW CONCLUSION

Outcome of the review:

	Continue	Modify	Stop
Technical Progress:	**X**		
Management and Consortium	**X**		
Dissemination + Exploitation:	**X**		
Future Plans:		**X**	
Overall Status of Project	**X**		

The outcome of the review is

- the project revealed satisfactory performance during the first year; recommendations of the last review have been conscientiously adopted. The level of integration has considerably increased, mainly in terms of integration between work packages and effort taken to build a HYCON identity across consortium members and industrials associates;
- the consortium needs to be congratulated for its common management of resources both with respect to the common training activities (e.g. the successful organisation of the summer school) and the exchange of personnel integrating resources from Marie/Curie into the HYCON objectives; the consortium should pursue the HYCON activities further under due observation of the recommendations outlined above; the workplan for the next 18 month has been accepted with qualifications.

11 NEXT REVIEW MEETING

Notwithstanding the agreement of the second annual review meeting that will take place around **25-27 September 2007** in Zurich, the consortium will be prepared for a midterm review with limited scope.

Reviewers' signatures:

Holger Karl

Véronique Pevtschin

Gabriel Leen

Peter Caines

12 APPENDICES

12.1 Status of project reports and deliverables

Most of the deliverables – except for the following deliverables D3.5.1, D4c.4.1 and D5.4.4 (see Rec.3) -- and the progress report are accepted as they are. Some deliverables have slight weaknesses but the reviewers feel that requiring modified version will generate additional delays that are not compensated by the potential advantages of updated deliverables. The main issues about lack of analysis in certain deliverables linked to the EIHS will automatically be taken into account when the decision milestones about the EIHS are reached.

12.2 List of participants

Name	Organisation	Email
Rolf Riemenschneider	European Commission	Rolf. Riemenschneider @cec.eu.int
Peter Caines	McGill University	peterc@cim.mcgill.ca
Gabriel Leen	University of Limerick	Gabriel.Leen@ul.ie
Holger Karl	University Paderborn	holger.karl@uni-paderborn.de
Véronique Pevtschin	Tecsin	v.pevtschin@alum.mit.edu
Françoise Lamnabhi-Lagarrigue	CNRS	lamnabhi@lss.supelec.fr
Alberto Bemporad	University of Siena	bemporad@dii.unisi.it
Sebastian Engell	University of Dortmund	Sebastian.engell@bci.uni-dortmund.de
Eduardo Camacho	University of Sevilla	Eduardo@cartuja.us.es
Manfred Morari	ETHZ	Morari@aut.ee.ethz.ch
Jan Lunze	Ruhr University Bochum	lunze@esr.ruhg-uni-bochum.de
Andrea Balluchi	PARADES	
George Bastin	CESAME, day 1	
Antonio Bicchi	University of Pisa	
Karl-Henrik Johansson	KTH	
Elisabeth Kohler	CNRS, day 2	
Joseph de Macedo	FIST	
Fortunato Santucci		

12.3 Agenda

Date: 5 & 6 October 2005

Venue: European Commission
Beaulieu 33
1160 Brussels, Belgium

Wednesday, 05 October 2005

From	To	Topic	Speaker
09:45	10:15	Reviewers closed session	
10:15	10:45	Project overview including the implementation of the previous review recommendations	F. Lamnabhi-Lagarrigue
10:45	11:05	Administrative and contractual management plans	FIST – J. de Macedo
11:05	11:20	Coffee Break	
11:20	11:40	WP3 achievements and milestones M7-M12	S. Engell
11:40	12:00	WP2 achievements and milestones M7-M12	E. Camacho
12:00	12:20	WP5 achievements and milestones M7-M12	J. Lunze
12:20	13:45	Lunch	
13:45	14:00	WP4a achievements and milestones M7-M12	M. Morari
14:00	14:15	WP4b achievements and milestones M7-M12	S. Engell
14:15	14:30	WP4c achievements and milestones M7-M12	A. Sangiovanni-Vincentelli
14:30	14:50	Coffee Break	
14:50	15:05	WP4d achievements and milestones M7-M12	K.H. Johansson
15:05	15:30	WP6 achievements and milestones M7-M12	A. Balluchi
15:30	16:30	WP1 & EIHS achievements, milestones, planning	A. Bicchi / A. Bemporad
16:30	17:00	Vision and Outlook of Hybrid Control	J. Lygeros
17:00	18:00	Reviewers closed session	

Thursday, 06 October 2005

From	To	Topic	Speaker
09:00	09.30	Discussion on administrative procedures	(optional)
09:30	09:50	Dissemination M1-M18	F. Lamnabhi-Lagarrigue
09:50	10:20	Conclusions and feedback of Day 1	Commission / Experts
10:20	10:40	Coffee break	
10:40	11:00	Objectives, Challenges, Milestones of the second year	F. Lamnabhi-Lagarrigue
11:00	11:15	WP1 & EIHS planning & negotiation	A. Bicchi / A. Bemporad
11:15	11:30	WP3 planning & negotiation of M13-M30	S. Engell
11:30	11:45	WP2 planning & negotiation of M13-M30	E. Camacho
11:45	12:00	WP5 planning & negotiation of M13-M30	J. Lunze
12:00	12:15	WP4a planning & negotiation of M13-M30	M. Morari
12:15	12:30	WP4b planning & negotiation M13-M30	S. Engell
12:30	14:00	Lunch	
14:00	14:15	WP4c planning & negotiation of M13-M30	A. Balluchi
14:15	14:30	WP4d planning & negotiation of M13-M30	F. Santucci
14:30	14:45	WP6 planning & negotiation of M13-M30	M. Morari
14 :45	15:30	Reviewers closed session	
15:30	16:00	Conclusions and feedback	Commission / Experts
16:00		End of Review	