

SUMMARY RECORDS

52nd Meeting of

GARTEUR Group of Responsables for

Structures and Materials

The meeting was held at CIRA, Capua– Italy on 21/22 April 2005

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ATTENDANCE LIST
FRANCE

T. Khan	ONERA, Châtillon
R. Ohayon	CNAM, Paris

GERMANY

H. Schröder	EADS AIRBUS, Bremen	IPoC
K. Rohwer	DLR, Braunschweig	

ITALY

A. Riccio	CIRA, Capua	
A. Minuto	Alenia, Pomigliano d'Arco	IPoC
Col. O. Spedicato	MoD	
Lt.Col. Castellari	MoD	

THE NETHERLANDS

H. H. Ottens	NLR, Marknesse- Noordoostpolder	chairman
J.F.M. Wigenraad	NLR, Marknesse- Noordoostpolder	
Th.M.C. van der Helm	NLR, Marknesse- Noordoostpolder	secretary

SPAIN

J. Maroto Sanchez	INTA, Madrid
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SWEDEN

H. Ansell	Saab AB, Linköping	IPoC
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UNITED KINGDOM

P. Curtis	DstL, Salisbury	
J. Dee	Airbus UK	IPoC

Excused

THE NETHERLANDS	L. Hootsmans	Fokker, Papendrecht	IPoC
UNITED KINGDOM	P. Gates	BAE Systems Airbus, Filton	IPoC
SWEDEN	S. Nilsson	FOI, Stockholm	
SWEDEN	A. Blom	FOI, Stockholm	
FRANCE	M. Mahé	AIRBUS France, Toulouse	IPoC

**GoR - Structures and Materials,
52nd Meeting held at CIRA, Capua - Italy, on 21/22 April 2005
21 April 14.00 p.m.**

AGENDA
1. Opening remarks and adoption of Agenda
2. Summary Records 51st GoR meeting
3. Action Items

51.1	Tasadduq Khan	Try to contact Dassault for a new IPoC.
51.2	Harold Ottens	Transfer the GARTEUR website to NLR. The website should then be available in 1-2 months.
51.3	Paul Curtis	To find out more about the members in the international birdstrike group (Europe + US?)
51.4	Paul Curtis	Check materials manufacturers. He will circulate the final proposal.
51.5	All	All GoR members should inform each other on a regular basis about developments on nanotubes.
51.6	Jonathan Dee	Will give a presentation on nanotubes at the next GoR meeting.
51.7	Harold Ottens	To check with Flight Mechanics Panel chairman on 'Morphing wing' program and send information to Khan.
51.8	Sören Nilsson	Prepare a short presentation on shape control actuators for the next GoR meeting.
51.9	Harold Ottens	Check for SM-AG 29 if signed papers of SAAB have been received.
51.10	Harold Ottens	Send basic GARTEUR documents to Dr. Schröder.
51.11	Rien van Houten	Put SM-AG 25 report on the GARTEUR website.
51.12	Paul Curtis	Check whether letters of Adherence for SM-AG 29 have been received.
51.13	Harold Ottens	Sent copy of letter of Adherence for SM-AG 29 from INTA to Paul Curtis
51.14	Paul Curtis	Contact ONERA for possible interaction in SM-AG 29.
51.15	Harold Ottens	Finalise proposal for SM-EG28, Material properties During Curing.
51.16	Harold Ottens	Inform GoR about what is going on in the ERA-Net.
51.17	Aniello Riccio	Make one page description of new activity on delamination growth.
51.18	Tasadduq Khan	Make one page description of new activity on smart actuators.
51.19	Hans Ansell	Make one page description of new activity on high speed machined parts.
51.20	Paul Curtis	Prepare a short presentation on methods for mass estimation.
51.21	Paul Curtis	Prepare a short presentation on thru-thickness properties due to stitching.
51.22	Paul Curtis	Prepare a short presentation on high temperature composite applications.

4. Progress reports and status on current AG's

 AG 27 *Fractographic Aspects of Fatigue Failure in Complex Composites*

P. Curtis

 AG 28 *Impact Damage and Repair of Composite Structures*

K. Rohwer

AG 29 *Interchangeability composite material*

P. Curtis

Check letters of acceptance and letters of adherence per participants.

5. Progress reports on current EG's

EG 28 *Material Properties during curing*

H.H. Ottens

EG 29 *Birdstrike 2*

P. Curtis

6. Possible new activities, preparation pre-proposal (A4-format)

1. *Delamination growth*

A. Riccio

2. *Smart actuators*

T. Khan

3. *Structural integrity high speed machined parts*

H. Ansell

7. Technology watch and new ideas

8. Presentations

- Jonathan Dee: nanotubes (AI 51.6)
- Sören Nilsson: shape control actuators (AI 51.8)
- Paul Curtis : - methods for mass estimation (AI 51.20)
 - thru-thickness properties due to stitching (AI 51.21)
 - high temperature composite applications (AI 51.22)

9. New chairmanship

2006-2007 chairmanship Spain

10. Report from Council Meeting, 9 and 10 March in Madrid

11. ERA-NET: Air TN and GARTEUR

12. Website update

13. Any other business

14. Date and place of next meeting:

53rd meeting: 20 / 21 October 2005 in France

54th Meeting : Spring 2006 in Spain

15. Closure of the meeting on 22 April at 11.00 hours

11.00 hours: Tour around CIRA facilities

Summary Records

1. Opening remarks – Adoption of agenda

The Chairman, Harold Ottens, opened the meeting at 14.00 hours on Thursday and welcomed the participants, in particular the two gentlemen from the Italian MoD; Col. Ottavio Spedicato and Lt. Col. Castellari, who were invited by CIRA. Klaus Rohwer and Hans Ansell were arriving a little later.

We received word from Sören Nilsson, Luc Hootsmans, Anders Blom, Peter Gates and Michel Mahe that they will not be attending the meeting.

The agenda was adopted with the following amendments.

Added to the agenda, under agenda item 6, is a technical proposal from the GoR Helicopters on EG23: “Technical proposal for the establishment of a GARTEUR Action Group on “Improvement of SPH methods for application to helicopter ditching”.

Also added under agenda item 6 is a second proposal by D. Osmont.: “Health Monitoring”.

Another proposal “Damocles3” by Aniello Riccio is added to agenda item 6 as well.

Aniello Riccio asked the chairman to follow the agenda in an efficient order as the two members of the MoD will only participate on 21 April.

2. Summary Records 51st GoR meeting

The Summary Records of the 51st GoR meeting were approved. There were a few typing errors **(AI Thea)**.

3. Action Items 51.1 up to 51.22

AI 52.1

As T. Khan confirmed, Harold states IPoC M. Mahe can be removed from the list. **(Action Item 52.1 ⇒Thea)**.

AI 51.1:

T. Khan states that Dassault does not show much interest. P. Curtis asks about Philip Vauté. H. Ottens wants to keep it on the Action List. **(Action Item 52.2 ⇒T. Khan)**.

Jonathan Dee mentions that 1 Airbus person represents all the Airbus Companies from the various countries.

AI 51.2

The website is now on the server at NLR; this will be further discussed under agenda item 12. All to check the correctness of the various information pages on the GARTEUR website. **(Action Item 52.3 ⇒All)**.

AI 51.3

P. Curtis hands over the list of the members in the International Birdstrike Research Group to the secretary. AI closed.

The IBRG participants are:

Stuart McCallum	Bae
Julian Reed	Rolls-Royce
Dick Parker	Pratt and Whitney
Paul Stone	Pratt and Whitney Canada
Bill Moring	Honeywell
Dan Bowman	UDRI
Geoff Frank	UDRI
Roger White	Natural Impacts
Steffan Schwantz	University of Oxford
Michelle Willows	QinetiQ
John McColl	CAA
Richard Budgey	CSL

AI 51.4:

The final proposal for the AG29 is ready. The table was missing from the document: P Curtis provides the secretary with the table and states that Hexcel is now participating:

GARTEUR AG29 contributions by members (numbers in table for work packages are man-months). Additional contribution in EUR's are listed under miscellaneous.								
	SAAB	CIRA	INTA	QINETIQ	NLR	SICOMP	Imperial	HEXCEL
WP1	2			1	1	0.5		
WP2		0.5		1			10	
WP3		0.5						
WP4			1.5			1.8	10	1
WP5				1	2	1.3		
WP6				1	3			
WP7				0.5	2			
Misc (EUR)	8,000	10,000	30,000			800	20,000	
Prepared: March 2005								
By: Fahmi Ngah, Secretary GARTEUR AG29								

AI closed.

AI 51.5:

All GoR members should inform each other about the possible development on Nanotubes.

(Action Item 52.4 ⇒AI).

AI 51.6:

Jonathan Dee will still give a presentation on nanotubes at the next GoR meeting.

(Action Item 52.5 ⇒J. Dee).

AI 51.7

Harold checked with the Flight Mechanics Panel and informs the meeting that there was no clear interest in the "Morphing wing" program. Maybe an A4 proposal should be made. **(Action Item 52.6 ⇒R Ohayon).**

AI 51.8

S. Nilsson is not present. The presentation on shape control actuators will be postponed until the next GoR meeting in France. **(Action item 52.7 ⇒S. Nilsson).**

AI 51.9

During the meeting P. Curtis handed over all the relevant signed letters of Adherence (SAAB) for SM-AG29 to the secretary. AI closed.

AI 51.10

H. Ottens has sent the basic GARTEUR documents to W. Schröder. AI is closed.

AI 51.11

The SM-AG 25 report "Postbuckling and Collapse Analysis" is not on the GARTEUR website yet. **(Action item 52.8 ⇒ M.H. van Houten).**

AI 51.12

See AI 51.9. AI is closed.

AI 51.13

Harold Ottens sent the letter of Adherence for SM-AG29 from INTA to P. Curtis. AI is closed.

AI 51.14

ONERA is not participating in the AG29. France has a national programme on the same subject. T. Khan will find out whether information can be exchanged and report in the next GoR (France).

(Action Item 52.9 ⇒ T. Khan).

AI 51.15

The finalising of the SM-EG28 proposal does not require action now. In the next GoR meeting a decision must be made whether to start an AG or not (Action Item 52.10 ⇒ J. Wiggeraad).

AI 51.16

Harold will inform the meeting on ERA-Net under agenda item 11. AI is closed.

AI 51.17

Aniello Riccio wrote one A4 page on "Delamination growth" (Enclosure 1) which will be discussed under agenda item 6. AI is closed.

AI 51.18

Tasadduq Khan provided a one page description on "Smart actuators" (Enclosure 2), which will be discussed under agenda item 6. AI is closed.

AI 51.19

Hans Ansell wrote a one page description on "High speed machined parts" (Enclosure 3), which will be discussed further under agenda item 6. AI is closed.

AI 51.20

Paul Curtis will give a presentation on "Methods for mass estimation" under agenda item 8. AI is closed.

AI 51.21

Paul Curtis will also give a presentation on "Thru-thickness properties due to stitching" under agenda item 8. AI is closed.

AI 51.22

Paul Curtis will inform the meeting on "High temperature composite applications" under agenda item 8. AI is closed.

Aniello Riccio introduced Dr. Domenico Tescione who gave a general presentation on their institute CIRA. See Appendix A for viewgraphs. In the CIRA Structures and Materials Department work approx. 100 people. CIRA has a very small tow placement machine. P. Curtis mentions that they have a lot of work in this area in the UK. Perhaps this could be an EG topic?

See also webpage: www.cira.it.

4. Progress reports and status on current AG's

SM-AG 27 *Fractographic Aspects of Fatigue Failure in Complex Composites:*

As the AG27 was introduced so long ago it is not very easy to trace the letters of acceptance and adherence.

Paul Curtis who is the Monitoring Responsible, presented the current status of the work in Action Group 27. The relevant viewgraphs are presented in Appendix B. The countries involved are UK, France, Sweden, The Netherlands, Germany and Spain.

The work is behind schedule, there are delays in procuring materials; many AG27 members have no more funding for activity. The work done so far will be reported and the AG will be closed. The original programme is not completely executed. A final report should be ready by the end of 2005.

SM-AG 28 *Impact Damage and Repair of Composite Structures*

The Monitoring Responsible, Klaus Rohwer informed the meeting of the progress and status on AG28. The viewgraphs are presented in Appendix C.

Harold states that the council insists on the letters of adherence and acceptance. Klaus will take action on this and approach the person in charge of the AG28. **(Action Item 52.11 ⇒Klaus Rohwer).**

Klaus Rohwer stated that it is difficult to say what the timescale looks like because there are many different subjects in this Action Group. However it is better to focus on 1 subject. Tasadduq Khan reports that Y. Ousset, the man who is doing the work has changed jobs and is retiring. He will not be replaced. Therefore F. Roudolff cannot report on the work. Klaus Rohwer will ask F. Roudolff how to finalise this work, have the final report written and then report at the next meeting accordingly. Harold suggests to get the Action Group (vice-chairman is B. Falzon) together and discuss how to solve this. **(Action Item 52.12 ⇒Klaus Rohwer).**

SM-AG29 *Interchangeability of composite materials*

Paul Curtis handed over all the Letters of Adherence (from INTA, Imperial College, QinetiQ, SICOMP, SAAB, CIRA, and Hexcel). France is not participating. Paul Curtis gives an explanation on SM-AG29. **See Appendix D for the viewgraphs.**

The next meeting for the Action Group is planned for June 2005. Representatives are QinetiQ, Hexcel and the Imperial College from the UK, SAAB and Sicomp Sweden, INTA Spain and CIRA Italy. Paul advised the Action Group to contact EASA. A possible participation next year could be of Airbus UK, Spain and Germany. J. Dee asks for the contact person at UK Airbus; Paul will find out for him. **(Action Item 52.13⇒Paul Curtis).**

5. Progress reports on current EG's

SM-EG 28 *Material Properties during curing*

Harold Ottens states that the proposal, made by NLR, is ready, but only 3 participants are interested. Jaap will send around the proposal. **(Action Item 52.14 ⇒J. Wiggeraad).** Then during the next GARTEUR GoR meeting in Fall 2005, it should be decided who wants to participate. **(Action Item 52.15 ⇒All)**

SM-EG 29 *Birdstrike 2*

P. Curtis presents the progress and status on the Birdstrike 2 activities, **see Appendix E for the viewgraphs.**

The GoR should now take a decision to form an AG. The UK, Germany, France and the Netherlands are interested.

José Maroto Sanchez replied Paul Curtis that INTA has capabilities and is also interested in this activity.

Sonaca, Belgium is also interested. Harold presented this to the Council, but Belgium is not a member of GARTEUR.

First the letters of adherence and acceptance should be issued and signed. CSL = like a CIRA in Belgium.

The meeting decides to form an Action Group, AG30 named: "High velocity impact".

Paul proposed that Roger Ohayon be the monitoring responsible for this AG; Michelle Willows is the chair-person. Roger Ohayon will ask Michelle Willows to give a presentation on AG30 S&M. **(AI 52.16 ⇒R. Ohayon).**

6. Possible new activities, preparation pre-proposal (A4-format)

0. Damocles 3

Aniello Riccio gives his presentation and states that the final meeting on this project will be in May. **Viewgraphs are shown in Appendix F.** The proposal was written by A. Clarke (QinetiQ), R.J.C. Creemers (NLR) and A. Riccio (CIRA) **(see enclosure 5).**

Paul Curtis states that in the past the 3 parties were operating in a European defence programme. This required a lot of preparation time and it is very easy to collaborate in GARTEUR. Paul proposed to work for this activity under the GARTEUR umbrella.

The MoD asks to send them the report on Damocles 2 when the work is finished.

Paul states that, as Harold already suggested, we create an EG and the interested parties contact Aniello Riccio or Paul Curtis. They might join the next meeting to discuss it.

We ask Aniello to approach the different countries and see if they want to join this activity to form an EG. Then indicate the person to participate and discuss this EG during the next meeting. The EG is now EG30 and called "Damocles3".

(AI-52.17 ⇒A. Riccio).

Aniello Riccio is the chair and will also report back as responsible for the time being. Harold suggests that may be Jaap Wiggeraad can be responsible for this EG.

Tasadduq Khan states that the subject "health monitoring" can be included in this EG. ONERA is interested.

Hans Schröder asks MoD Mr. O. Spedicato to bring it under EDA.

O. Spedicato says that the NL is not a member of EDA (European Defence Agency), this could be a problem, thus preferably work under the GARTEUR Group. He also states that if other nations are interested than the Italian MoD is also interested.

Italy is working in the AMOS program. (H.W. Schröder)

1. Delamination growth

Aniello Riccio presents the viewgraphs for a new activity on "Delamination growth", **see Appendix G**.

The chairman asks if there is enough interest on this project to proceed with an EG.

Paul Curtis stated that from the Imperial College students point of view there is enough interest. The NL is working on global methodologies thus is interested.

Klaus Rohwer says that the topic is of interest to DLR and will contribute to an EG.

EADS (H.W. Schröder) will contribute to this EG.

UK Airbus, J. Dee will probably contribute to this EG and will contact the person in charge.

Tasadduq Khan will pass on the information within ONERA as he is not sure whether France is interested.

Harold Ottens concludes there is enough interest. A chairman needs to be nominated. A. Riccio will check within CIRA, within the next 2 weeks. **(Action Item 52.18⇒A. Riccio)**. The meeting decides on an Exploratory Group called EG31: "Damage growth in composites".

2. Smart actuators

Roger Ohayon refers to the conclusions in the 51st summary records. There is a project on actuators within ONERA. An evaluation needs to be made of what is available. Roger Ohayon refers to an ICAST conference which is on 10 and 11 October 2005 in Paris www.icast2005.org.

CIRA, DLR, DSTL and ONERA, who proposed it, are interested to form an EG.

Paul Curtis states that they have a lot of ongoing work and will ask Peter Lloyd to attend the EG meeting **(Action Item 52.19⇒P. Curtis)**

Hans Ansell mentions that Saab Dynamics has been working on manufacturing of missiles and will ask Saab Dynamics to join the EG. Harold will check with NLR. Jonathan Dee Airbus UK will discuss "wing tip fence" internally and will contact the University of Bristol. Arturo Minuto will check within Alenia. **(Action Item 52.20⇒H. Ansell, J. Wiggendaad, J. Dee, A. Minuto)**

The meeting will check the interest at home first and then decide at the next meeting whether to form an EG.

3. Structural integrity high speed machined parts

Hans Ansell explains the activity (**see enclosure 3**) and states that 3 aspects are involved:

1. Assessment of damage tolerance of major integral structures
2. Life improvement techniques for high speed machined thin gauged integral structures
3. Repair of post-buckling thin gauged integral structures.

4. Health monitoring

A 2nd proposal for Health monitoring was written by D. Osmont, Onera. **(Enclosure 4)**.

5. EG23 GoR Helicopters

Harold mentions that the EG23 Helicopters GoR proposal is already an agreed AG: AG15. **(See enclosure 6)**

Jaap Wiggendaad refers to the Crahvi project and states that it is good to join forces. Roger Ohayon will be the transfer co-ordinator and should exchange information between the Helicopters and Structures and Materials Group of Responsables. Then later a workshop should be organised and a joint meeting. **(Action Item 52.21⇒R. Ohayon)**

Jaap will inform the chairman of the Helicopters group next Fall meeting of the council. Also ask Mr. F. Toulmay of AG15 (EG23) to give a presentation during this meeting **(Action Item 52.22⇒J. Wiggendaad)**

7. Technology watch and new ideas

The chairman states that there are no more new ideas; a lot of topics have already been discussed during the meeting.

8. Presentations

Sören Nilsson is not present to give a presentation on "Shape control actuators (AI 51.8).

Paul Curtis gives a presentation on "Methods for mass estimation" (AI 51.20). **See Appendix J for the viewgraphs.**

Harold Ottens asks the meeting to check and for the next meeting decide whether it is, both civil and military, of enough interest to form a Garteur Exploratory Group. **(Action Item 52.23 ⇒All)**

Paul Curtis also presents a summary on “thru-thickness properties due to stitching” (AI 51.21) **See Appendix K for the viewgraphs.**

Paul confirms that this topic would fit in the Damocles project.

Furthermore Paul gives a short explanation on “High temperature composite applications” (AI 51.22).

The chairman closed the meeting at 17.30 on 21 April.

Break for dinner; leave hotel at 20.00 hrs.

Harold proposes to start the meeting on 22-4 at 09.00 hrs, then tour facilities at 11.00 hrs, lunch at 12.30 hrs as some of the members want to leave at 12.30 hrs to catch a flight. We therefore will have to finish the meeting before 11.00 hrs.

The meeting was continued on Friday 22 April, 09.00 hrs.

Agenda item 4, continued

Jonathan Dee gave a small explanation on “Nanotubes” (AI 51.6) **(See appendix H)**. Harold asks the meeting to inform each other of any developments on Nanotubes. The NLR management keeps asking about news on Nano technology. Tasadduq Khan said that there was nano technology work done on actuators but this did not give interesting results.

9. New chairmanship

Harold informs the meeting of his retirement as per 1 July 2005 from NLR and from the GARTEUR Group of Responsables for Structures and Materials. Harold proposes Jaap Wiggeraad of NLR to chair the Fall meeting in France. The meeting agrees and so does Jaap!

In 2006 the chairmanship will rotate. Harold asks José Maroto Sanchez whether Spain will chair the GARTEUR GoR S&M for the next 2-year period. José Maroto Sanchez agrees to this. Paul memorizes that Italy should provide the vice chairman. Harold requests Aniello Riccio to discuss this within CIRA.

10. Any Other Business

Paul Curtis states that there should be more involvement of the Universities from other countries. Harold agrees. **(Action Item 52.24 ⇒All)**.

Klaus Rohwer will retire next year.

Hans Wolfgang Schröder will also retire next year.

11. ERA-NET: Air TN and GARTEUR

Harold Ottens gives a presentation on the ERA-Net. The viewgraphs are presented in **Appendix L**. Harold will ask Bas Oskam for the proposal and the EU and will send this to all the GoR S&M members **(Action Item 52.25⇒ H. Ottens)**.

12. Website update

The GARTEUR GoR website is now placed on the NLR server and needs to be updated some more. Some links on the S&M website should be protected with a password and the links with general information can be made public.

Summarised the meeting decided as follows:

GoR SM :	public ; annual report under header “activities”
Members:	(only the members) public
IPoC's:	Public
Activities:	Password protected
Benefits	Public
Technical highlights	Public
AG's and EG's	1 st level public, 2 nd level password protected

Paul suggests to make the 1st level public i.e. AG's /EG's and protect the second level, the relevant information under these Groups with a password. The members of the Action Groups and the Exploratory Groups should be able to put information on the website.

13. Any other business

Hans Wolfgang Schröder requests to have the appendices on the website as soon as possible. Thea will take care of that and inform the GoR by e-mail.

Tasadduq Khan asks about a certificate for the members who leave the GoR.

Paul Curtis thanks the chairman for his work as GoR S&M chairman and wishes Harold a happy retirement.

14. Date and place of the 52nd meeting

The 53rd meeting is planned on 20/21 October 2005 at ONERA in Paris, France.

The spring meeting, the 54th, will be on 20/21 April 2006 in Torrejon, Spain.

The 55th meeting in Fall 2006 will be held in the UK.

15. Closure of the meeting at approximately 11.30 hours.

Harold Ottens closed the meeting at approx. 11.30 hrs.

An interesting guided tour at the CIRA facilities was arranged by the host Aniello Riccio; the Icing Wind Tunnel, the Plasma Wind Tunnel (Scirocco) and the Drop Tower "LISA" were visited.

Action Item List

At this 52nd meeting of the GoR S&M on 21/22 April 2005 at CIRA, Capua the following action items were recorded:

Action Item	Responsibility	Action
52.1	Thea van der Helm	Remove M. Mahé from the IPoC list
52.2	Tasadduq Khan	Try to contact Dassault for a new IPoC
52.3	All	To check the correctness of the various information pages on the GARTEUR website
52.4	All	All GoR members should inform each other on a regular basis about developments on nanotubes
52.5	Jonathan Dee	Will give a presentation on nanotubes at the next GoR meeting
52.6	Roger Ohayon	Maybe an A4 proposal should be made on "Morphing wing" program
52.7	Sören Nilsson	Prepare a short presentation on shape control actuators for the next GoR meeting
52.8	Rien van Houten	Put SM-AG 25 report on the GARTEUR website
52.9	Tassaduq Khan	ONERA is not participating in the AG29. T. Khan will find out and report in the next GoR
52.10	Jaap Wiggenraad	The finalising of the SM-EG28 proposal does not require action now see also 52.14 / 52.15
52.11	Klaus Rohwer	Approach the person in charge of the AG28 for letters of adherence and acceptance
52.12	Klaus Rohwer	Ask F. Roudolff how to finalise AG28 work and the final report
52.13	Paul Curtis	Ask Airbus UK contact person name for Jonathan Dee
52.14	Jaap Wiggenraad	Send around NLR proposal EG28 on Materials Properties during curing
52.15	All	In Fall 2005 meeting decide who wants to participate in EG28: Material properties during curing
52.16	Roger Ohayon	R. Ohayon will ask Michelle Willows to give a presentation on AG30 S&M.
52.17	Aniello Riccio	Approach the different countries and see if they want to join this activity to form an EG. Then indicate the person to participate in the next meeting
52.18	Aniello Riccio	Chairman for Exploratory Group called EG31 : "Damage growth in composites".
52.19	Paul Curtis	Ask Peter Lloyd to attend the EG meeting on smart actuators
52.20	Ansell, Wiggenraad, Dee, Minuto	Check interest to join the EG on smart actuators
52.21	Roger Ohayon	Will be the transfer co-ordinator and should exchange information between the Helicopters and Structures and Materials Group of Responsables. Then later a workshop should be organised and a joint meeting
52.22	Jaap Wiggenraad	Inform chairman Helicopters group next Fall meeting of the council and ask Mr. F. Toulmay of AG15 (EG23) to give a presentation during this meeting
52.23	All	Decide whether it is, both civil and military, of enough interest to form a Garteur Exploratory Group on 'Methods for mass estimation'
52.24	All	There should be more involvement of the Universities from other countries
52.25	Harold Ottens	Ask B. Oskam and the EU for proposal on ERA-NET: Air TN and send this to all the GoR S&M members
52.26	Thea	Put Appendices on the GoR website straight away and mail the members accordingly. Will mail the particulars of Henk Jan ten Hoeve to Hans Ansell Will update the meeting-schedule with dates and places (see website).

Garteur Proposal about Delamination Growth in Composite Structures

Title : Delamination Growth in Composite Structures

Author : Aniello Riccio

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The high specific strength and stiffness of laminated composites make them suitable for use in aircraft structures. However, the high sensitivity of composites to damage, due to impacts with foreign objects or caused by manufacturing defects, is one of the most important causes of their minor role in aerospace industries, especially for the design and manufacturing of primary components. Hence, in order to design efficient composite structures, a “damage tolerant” design approach should be adopted. According to this kind of approach, structures should be designed capable to withstand the design load even when a certain amount of damage is present. This is the reason why, in recent years, damage tolerance have become one of the most important research topics in the structural analysis of composite materials. In particular, as a first step in supporting this challenging structural design approach, previous S&M GARTEUR AGs (16,22 and 28) have been focused on the investigation of the influence of impact-induced damages on the mechanical behaviour of composite wing panels. However a compulsory need of efficient techniques able to support the damage tolerant design of a composite component still exists.

The objective of this proposal is:

“to develop integrated numerical / experimental methodologies capable to take into account the presence of damage and its evolution in composite structures from the early phases of the design (conceptual design) up to the detailed FEM analysis and verification phase”.

The main fallbacks would be:

- 1) Reduction of the overall composite design time and costs**
- 2) Improvement of composite components performances**
- 3) Reduction of the composite components weight**
- 4) Reduction of certification costs**

Among the several kinds of damages that can affect composite structures, in this proposal we will focus the attention on delaminations, which can be very dangerous and can lead to a premature collapse of the structures, in particular under compressive loading conditions. Of course, since delaminations are always associated with matrix cracking and fibre failure, the development of a numerical tool able to take into account the propagation of delaminations together with other failure mechanisms would be desirable. Moreover, when multiple delaminations are involved, proper techniques which simulate side phenomena governing structural behaviour of composites such as contact between delaminated plies should be considered.

The work could be organised according to the following scheme (suggestions are welcome):

- 1) Local Methodologies

- a. Local detailed Delamination growth methodologies
 - b. Local detailed progressive damage (PD) methodologies (fibre and matrix cracking)
 - c. Local combined delamination growth and PD detailed methodologies
- 2) Global “fast” methodologies
- a. Local “fast” Delamination growth methodologies
 - b. Local “fast” progressive damage (PD) methodologies (fibre and matrix cracking)
 - c. Local combined delamination growth and PD “fast” methodologies
- 3) Experimental Coupons Verification (optionally available experimental database)
- 4) Design of a benchmark structure (TBD – depending on available database and on ex-novo tests) and its experimental verification (proof of concept)

Garteur Proposal about Actuators

Title : Actuators for Aerodynamic Surfaces or Devices

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The concept of shape control has been proposed to improve the aerodynamic performances of flying structures. A typical project is the "Smart Wing". for which it is proposed to deform the wings using actuators or aerodynamic forces in order to obtain a better efficiency with respect to power consumption or an improvement of the performance. Such a project needs efficient actuators with high power density per unit mass and a good stability with respect to cycling. Such actuators are to our knowledge not available.

The design of actuators is a complex process because an actuator is not an active material, it is a structure (sometimes a system) containing an active material which is inserted in another structure in order to make it possible to deform it. The performance of an actuator depends on the actuator itself but also on the structure in which it is inserted. The design implies that the forces, deformations, power requirements, response time, number of cycles to perform, ... are defined. With this information it is then possible to choose an appropriate principle of action (active material, motor, ...) and then to proceed to the design of the actuator. It is not possible to rely on the design only but it is also necessary to make a demonstrator in order to check the efficiency of the actuator.

We propose, referring to the choice of an active material mentioned above, to compare the information available for each family of active material such as :

- 1) mechanical characteristic in free state, in blocked state, uni-axial state, plane stress state, ...
- 2) characteristics relative to the action field (temperature field, electric or magnetic field, ...)
- 3) characteristics of the coupling (constitutive law characteristics, coupling factors)
- 4) loss factors, characteristic response time
- 5) maximum deformation, maximum stresses, maximum applied field
- 6) energy effectiveness, power needs ...
- 7) stability with respect to cycling

The active materials could be piezo-electric, electro or magneto strictive, single crystals, shape memory alloys, magnetic shape memory alloys, electro and magneto rheologic, electro-active and electro-strictive polymers....

We propose to compare the information available for commercially available actuators and motors, analyse and test some of them and compare the results of these analysis and tests.

We finally propose to define a few simple applications (vortex generator, trailing edge flap,, ..) and to compare the processes of design and solutions for these peculiar applications.

The objective is to improve the process of design of actuators by comparing several approaches for a same application and to point out the key problems to be solved.

Garteur Proposal on Structural integrity of thin walled integral metallic structures

Title : Structural integrity of thin walled integral metallic structures

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High speed machining (HSM) has become a powerful tool for cost efficient manufacturing of high performing metallic structures. Machined parts reduce several steps in assembly and by manufacture bulkheads and similar components from thick plate, rather than forging, also reduce the time required to make design changes. Since HSM introduces much lower loads into the part during machining it is possible to design integrated thin walled structures that earlier only were possible to manufacture from sheet product form as assemblies. The integral technique may however have some drawbacks on structural integrity issues which have to be assessed. For conventional assemblies, damage tolerance is in many cases and to some degree inherent by the many parts that build the structure. An integral structure does not have that attribute since a crack has no natural limit prior to complete failure. It is of concern to investigate such scenarios including all events from probability of detection of cracks during NDI to residual strength conditions. Also of concern are techniques for life improvements of thin gauge integral structure and repair of such structure due to the difficulties and costs to replace large integrated structural parts.

The project proposal consists of three major tasks:

1. Assessment of damage tolerance of major integral structures
2. Life improvement techniques for high speed machined thin gauged integral structures
3. Repair of postbuckling thin gauged integral structures

Each task contains numerical or experimental demonstrations on structural parts of developed technology and progress and comparisons with existing knowledge and experience of conventional building techniques.

Garteur Proposal about Health Monitoring of Structures

Title : Smart Composite Repairs for Metallic or Composite Structures

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When structures are damaged (cracks for metallic structures and delaminations for composite structures for example) it is possible to make a composite repair. Such a repair may be made by using patches of composite materials applied onto the structure in the vicinity of the damage. The purpose of this repair is to prevent the extension of damage in the structure. In particular, one has to unload the damaged area in order to reduce the stresses around the damage and load the patch. This is possible if the shear stresses at the interface between the structure and the repair are large enough and the repair is of a sufficient dimension. The design of the repair is not our concern.

The repair may lose its efficiency if, for example:

- 1) the bonding has defects
- 2) the bonding becomes damaged
- 3) the composite repair is damaged by an impact (inducing a delamination for example)
- 3) the repair is ageing, and is no longer strong enough.


To make sure that the repair is efficient enough, it is possible to use classical END techniques (thermography, shearography, US lasers, It is also possible to equip this repair when manufacturing it with embedded sensors and transducers in order to obtain what will be called a "smart repair". This sensors and transducers could be optical fibres, piezo-transducers; ... What is intended is to obtain a repair with an easier monitoring than the one allowed by END.

We propose, for a generic defect in a metallic plate (a crack like slit and a generic composite repair to be defined) to compare different monitoring techniques making it possible to :

- 1) monitor the bond between the structure and the repair (defects in the initial state),
- 2) monitor the ageing of the repair (material, bond)
- 3) monitor the occurrence of damages in the repair.

The objectives are :

- 1) to propose techniques of monitoring and study them from the theoretical point of view
- 2) to make a few dedicated experiments to assess the feasibility of the concepts developed in the theoretical studies
- 3) if possible, to do an experimental validation of the techniques

	<p style="text-align: center;">DAMOCLES3</p> <p style="text-align: center;">DAmage Management Of Composite Structures or Cost Effective Life Extensive Service</p>
OUTLINE DESCRIPTION OF THE RESERCH TECHNOLOGY PROGRAMME	
<p>Summary</p> <p>Composite aircraft structures are particularly vulnerable to impact damage, which is difficult to detect, may severely reduce the strength, and will require complicated repair. In addition they are often unfairly compared with metallic structure which permit controlled buckling between limit and ultimate load to optimise performance against weight. To date individual methods for design, inspection, damage growth (fatigue) assessment and repair of composite structures are available, used albeit at various levels of confidence. This leads to unnecessary conservatism, hence to high operating costs. Future military aircraft will contain a much higher share of composite components. To achieve a cost-effective service performance during the entire life cycle highlights the issues associated with damage management especially in post-buckled designs under fatigue loading need to be addressed. The present document contains a joint proposal by QinetiQ, CIRA and NLR for a research program towards these needs. The group welcomes additional partners from the EUCLID consortium who bring key skills in the development of novel composite structures.</p> <p>The program proposed builds on a current program, DAMOCLES 2, in which a low cost all composite wing structure is designed and manufactured with increased damage resistance and damage tolerance while taking into account repair considerations. The increased damage resistance/tolerance was achieved at the expense of a weight penalty and no use was made of the post-buckling regime.</p> <p>This proposal considers the advancements made under the DAMOCLES 2 programme and considers the operational issues of fatigue and proposes the development of an all-composite-wing structure which utilises post-buckling characteristics between limit and ultimate load. This sets the need for an all-embracing damage management method, including in-service inspection/repair and damage growth/residual strength prediction.</p> <p>The program will address the key issues of:</p> <ul style="list-style-type: none">• Novel structural elements considering post buckle design between limit and ultimate• Fatigue and delamination growth• In-service inspection/ repair / life extension <p>The duration of the program is three years and is Government (MoD) funded from within each organisation. It is proposed that the program is carried out subject to an MOU umbrella to protect the individual contributions. The level of funding is 250 Keuro p.a. over three years from each partner.</p> <p><i>Authors: Andrew Clarke (QinetiQ) , Ralf Creemers (NLR) , Aniello Riccio (CIRA)</i></p>	