MINUTES OF MEETING



FLACS-II TRAINING AND FLACS USER GROUP MEETING

Place: GexCon AS, Bergen, Norway
Date: 2-4 May 2007
Prepared by: Hans-Christen Salvesen, Olav R. Hansen.

Participants:

Kari Fredriksen	Akerkvaerner	Norway
Alexandre Lebas	BMT	UK
Chris Savvides	BP	UK
Maggie (Mai) Wang	BP	UK
Rasmus Nilsson	DNV	Norway
Aamund Langelid	DNV	Norway
Julian Duhart	Gaz De France	France
Noela Vazquez	Gaz De France	France
Are Bratteteig	GexCon	Norway
Bjørn Arntzen	GexCon	Norway
Ellen Østerbø	GexCon	Norway
Hans Christen Salvesen	GexCon	Norway
Idar Storvik	GexCon	Norway
Jan Roar Bakke	GexCon	Norway
Jens Melheim	GexCon	Norway
Kees van Wingerden	GexCon	Norway
Olav R Hansen	GexCon	Norway
Ole Jacob Taraldset	GexCon	Norway
Prankul Middha	GexCon	Norway
Rannveig Iversen	GexCon	Norway
Rikard Johnsson	GexCon	Norway
Torunn Stranden Davidsen	GexCon	Norway
Trygve Skjold	GexCon	Norway
Kiho Moon	Hyundai R&D	Korea
Samheon Jeong	Hyundai R&D	Korea
Jerome Hocquet	IRSN	France
Becky Wu	Lloyds Register	UK
Ed Bailey	Lloyds Register	UK
Mette Charlotte Roland	Norsk Hydro	Norway
Jean-Luc Revel	Rhoditech	France
Brynhild Olsø	Safetec	Norway
Alexandre Brigadeau	Scandpower	Norway
Anish Ravi	Scandpower	USA
Sverre Nodland	Scandpower	Norway
Tina Almhjell	Scandpower	Norway
Øystein Spangelo	Scandpower	Norway
Andreas Obrist	SKS	Switzerland
Henri Tonda	Total	France
Gauthier Polet	Tractebel	Belgium

Additional Distribution: FLUG mailing list

GexCon AS
P.Box 6015
NO-5892 Bergen, Norway

Visiting address:
Fantoftvegen 38
Fantoft

Telephone: +47 55 57 43 30
Telefax: +47 55 57 43 31
www.gexcon.com

Bank: 5210 05 26018
NO 979 879 342 VAT

1. Welcome

Olav R. Hansen from GexCon welcomed to the FLACS-II training course. He gave a presentation on work related to modelling of hydrogen dispersion and explosion, and also dispersion of toxic gas.

2. Homework Exercises, Wednesday 2nd May

Prankul Middha from GexCon went through Homework Exercise 2, Bang Box. The CASD template named "default+1" should be chosen for this exercise. When the geometry contains many repeated objects important for generation of turbulence during an explosion, it is recommended to avoid a grid size equal (or too close to) the object size. In the explosion region, cubical shape of the control volumes (CVs) is recommended.

It was noted that when a vent opening in CASD is made by using left difference (one object, set minus operation another object), some seemingly unphysical turbulence generation is observed by GexCon in some cases. GexCon plan to look more into this.

Chris Savvides from BP asked about more detailed information from the experiments of Exercise 2, to explain the difference seen between experimental results and simulated results.

Homework Exercise 3, hydrogen explosion in tube, was presented. It was noted that some numerical problems have been seen when the CV size (distance between 2 grid lines) is chosen less than 1.0cm. This is possibly related to that the turbulent length scale is comparable to the CV size. GexCon plan to look more into this, for the time being, it is recommended to avoid grid cells less than 1cm. It is possible to take into account heat transfer by specifying HEAT_SWITCH=1 in scenario setup and creating input file cs<job no.>.RAD where <job no.> is the job no. of the simulation considered. Due to relatively small size of the cross-section of the tube, radiation is expected to be of some importance in this case.

Homework Exercise 1, using model of the Advantica Spadeadam full scale test rig was presented, which involved the modelling of a dispersion and explosion test case. It was recommended that grid lines fit major walls, and that there are at least 5 to 6 CVs between decks. In general it is needed to refine the grid around the jet axis, using a stretch factor being up to 30-40% when smoothing the grid. When Pasquill class is defined, it is not necessary to define wind turbulence parameters. Meandering with field can be obtained by setting windgust=.TRUE. in a setup file. When igniting an inhomogeneous cloud from the fuel dispersion, it may be recommended to use an ignition region across 2 grid lines to get an effective ignition. When simulating explosion of inhomogeneous cloud from dispersion, it is in general recommended to keep both the wind field at boundary of computational domain and the jet leak release. The CVs should be (approximately) cubical in the central parts of the domain during the explosion simulation. If a strong pressure wave from such an explosion hits a boundary of the computational domain with wind boundary condition, then it will in general be an artificial reflection of the pressure wave at the boundary, but often this is at a relatively late time of the explosion when the essential part of the explosion evolvement is already over. This exercise also included explosion simulation of equivalent gas cloud Q9, slightly over-stoichiometric homogeneous cloud filling the whole module, and slightly under-stoichiometric homogeneous cloud filling partially the module.

Handout from all exercises was to be uploaded at the FLUG web-area after the meeting.

At the end of the day the participants visited the home of the composer Edvard Grieg, and listened to a small piano concert in his home.

3. FLACS-II training continued, Thursday 3rd May.

Ole Jacob Taraldset from GexCon Software did a presentation related to CAD import when using FLACS. When working on a local file system, the import time may be significantly shorter (compared

to communicating via a computer network) for heavy CAD import tasks. Øystein Spangelo from Scandpower suggested that geo2flacs identifies by name the geometrical objects being represented by a bounding box when importing to FLACS. Chris Savvides from BP suggested that bounding boxes and other special cases may be joined in a separate CASD macro file, preferable with a proper assembly structure (more easy to check). Chris Savvides also pointed out that it is preferable to use SI units ([m]) when exporting from Microstation. Further that dgn-files are not always perfect, it may in some cases be necessary to elaborate on the geometry representation afterwards. The GexCon utility program cofile1.0 can be used to get information about obstacle size distribution.

Idar Storvik from GexCon Software commented on the possibility to change output units in the cs-file, e.g. from barg (overpressure in bar) to Pag (overpressure in Pa), it this is done after a simulation is performed, the simulation must be rerun. When the FLACS user is only concerned with viewing the simulation results, it would be possible to extend flowvis in the future so that the user can choose other units than the default ones. Idar Storvik told about some advanced topics when using FLACS, among others; use of Linux/Unix scripts to perform set of tasks, utility tool comerge1.2 to merge, scale or rotate co-files, utility tool gm to make grids, tracer gas option, use of setup file cs<job no.>.WIND, frozen cloud concept, utility tool a1file.

Handout from the FLACS-II training was to be uploaded to the FLUG web-area.

At the end of the day, the group was taken to the GexCon large scale test site at Sotra to watch two explosion tests. In the evening GexCon invited the participants to FLUG-dinner at Bellevue Restaurant in Bergen.

4. FLUG meeting, Friday 4th May.

Chris Savvides (BP) welcomed and the agenda was adopted..

It was proposed that discovered bugs in FLACS relevant for the general FLACS user, are documented on the FLUG web site and also reported by e-mail from time to time, e.g. every 2 months when needed. Ole Jacob Taraldset (GexCon Software) told that GexCon now has a tracking system for bugs in FLACS (bugzilla).

It was a general impression that the FLUG members found it useful to be given FLACS exercises in connection to the FLUG-meetings. Better FLACS manuals and documentation of guidelines are wanted, preferably collected at one place. Olav R Hansen commented that important guidance document for FLACS included FLACS-training course handout (available at FLUG-web pages), FLACSv8.1 release notes, FLACS manual (in particular “Changes FLACS-99” section). GexCon promised to collect some of these guidance documents on the FLUG web-area.

Ole Jacob Taraldset (GexCon) told about the progress for the work on the new QT-version of FLACS (can be run also on Microsoft Windows OS). It was proposed that the new QT-version should be able to conveniently document the essential parts of scenarios and databases. It is proposed to develop the tool to be able to make an effective “sanity check” of scenarios (e.g. check for wrong ignition point), this could possibly involve a reduced flacs simulator for checking purposes.

A question was raised whether an Undo function could be made casd/flowvis. Ole Jacob Taraldset (GexCon) commented that an Undo function is very demanding to implement. Rasmus Nilsson (DNV) would like to have an autosave function in casd/flowvis.

In connection to lunch, a virtual reality demonstration was provided by the CMR Computing group showing how FLACS simulation results can be visualised using the VR-Safety tool developed in cooperation with Statoil and Norsk Hydro.

Chris Savvides (BP) suggested that for the first period after the QT-version release of FLACS (e.g. 6-12 months), the FLACS users should also have available earlier version of FLACS, in case of any starting problems with the QT-version.

Olav R. Hansen (GexCon) told that GexCon aimed to include in the new QT-version some kind of modelling indicating possible DDT, and an early fire model.

Kees van Wingerden (GexCon) gave an overview presentation on explosion protection. And Jens Melheim (GexCon) gave a presentation on pool models in FLACS.

The use of the equivalent cloud Q9 was briefly discussed.

Olav R. Hansen (GexCon) presented future R&D plans, this included among others; modeling of sloping terrain, vessel burst modelling.

Chris Savvides (BP) asked for a list of FLACS users around the world.

New FLUG meetings.
It was planned to combine the FLUG autumn meeting with a one day open seminar for the industry. The venue might be in Paris in cooperation Gaz de France.

Actions:

- Improve accessibility of guidance documents on the FLUG web-area, put focus on improvement of FLACS manuals and simplification of interfaces once FLACS-v9 has been completed and released.
- Prepare FLUG-homework for next FLUG-meeting
- Upload FLACS-II training handout to the FLUG web-area
- Provide list of users of FLACS

Agenda FLACS-II Training Course

cmr Gexcon

Wednesday 2 May

12:15 Lunch
13:00 Welcome to FLACS-II training
13:15 Homework Exercise 1, instruction, presentation of results and discussion
14:40 Coffee and refreshments
15:00 Homework Exercise 2, instruction, presentation of results and discussion
15:45 Homework Exercise 3, instruction, presentation of results and discussion
16:30 Overview of development of gas explosion research since 1980
17:15 End of presentations
17:30 Bus leaves for Troldhaugen and Edvard Grieg
19:30 Bus returns to city center and hotels

Thursday 3 May

08:00 Coffee and refreshments
08:30 FLACS-II training remaining elements, overview
08:40 FLACS-II Preprocessing, Geometry, CAD-import, discussion
10:00 Coffee and refreshments break
10:20 Ventilation and dispersion, discussion
11:45 Lunch
12:30 Explosion functionality, discussion
13:45 Coffee and refreshments break
14:05 Postprocessing
14:45 Discussion
15:20 End of presentations, prepare for bus trip
15:30 Bus leaves for Sotra Test Site
16:30 $50m^3$ Explosion demo (1 or 2 tests) at Sotra Test Site
17:15 Bus to Klokkarvik to catch Ferry to Hjellestad 17:30
18:30 Bus leaves for Bergen and Restaurant
19:15 GexCon invites to dinner at Bellevue Restaurant

Goals training:
Increase your ability to
- produce results with confidence
- be efficient in your work
- feedback to GexCon on improvements

Agenda FLUG Friday May 4

08:00	**Coffee and refreshments**	
08:30	**FLACS User Group Meeting, Adoption of agenda, minutes from Zurich**	**Chair: Chris Savvides, BP**
08:45	**Presentations from GexCon: FLACS-v9**	**Ole Jacob Taraldset**
09:40	**Overview of explosion protection**	**Kees van Wingerden**
10:00	**Coffee and refreshments break**	
10:20	**Presentations from users and GexCon**	
11:30	**Lunch and Virtual Reality Demo (3 groups, each 30 minutes)**	**Dag M. Ulvang, CMR**
13:00	**Presentations from users continued**	
14:00	**Overview of GexCon R&D activities and plans**	**Olav R Hansen**
14:30	**Discussion, next meeting**	
15:00	**End of meeting, taxis to airport or city centre**	