

A graphic consisting of several overlapping triangles in shades of grey, red, and black, arranged in a dynamic, abstract shape.

NAFEMS

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Achieving ISO 9001 accreditation and the role of the NAFEMS QSS, from the perspective of a small consultancy

Dr Steve Howell

Technical Director, Abercus





Agenda

- Introduction
- ISO 9001 and NAFEMS QSS
- Assessors and consultants
- High-level and low-level
- Save time and effort at point of use
- Keep it simple
- Summary
- Questions



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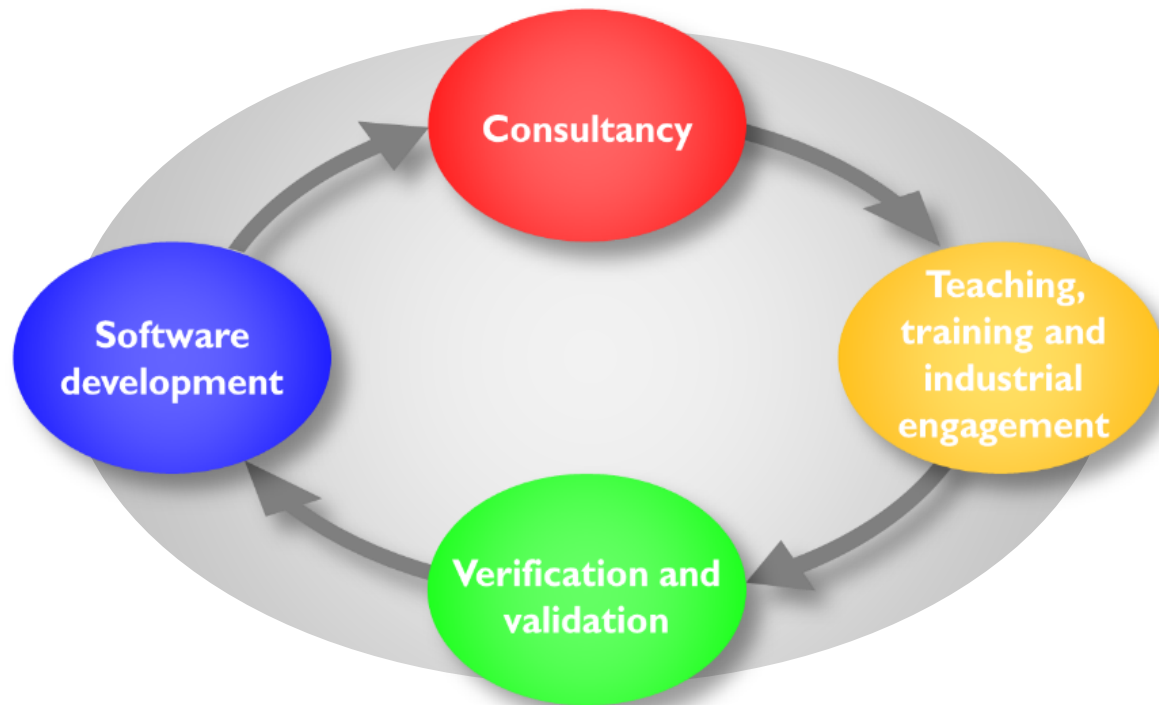
Introduction

- Abercus is a small independent consultancy specialising in advanced engineering simulation within the energy sector – CFD, FEA, the development of bespoke software tools and teaching/training
- Abercus was founded in 2010 when a number of former colleagues reunited with the aims of providing open simulation consultancy, together with supporting software and training to allow us to share our experience and capabilities with our clients and wider industry
- Abercus has been a member of NAFEMS since early 2011 – it was the first organisation that Abercus joined.



Introduction

- Abercus is a small independent consultancy specialising in advanced engineering simulation within the energy sector – CFD, FEA, the development of bespoke software tools and teaching/training.





Introduction

- The members within our team have worked in a variety of organisations previously including small, medium and large consultancies, and universities
- We all had an understanding of what ISO 9001 is and how it can be implemented but none of us had actually implemented an ISO 9001 previously
- As a small consultancy, Abercus was initially hesitant to pursue formal ISO 9001 certification because of the investment required in terms of both time and money
- Instead, Abercus implemented a quality management system (QMS) designed in line with our understanding of ISO 9001.



Introduction

- In 2015 Abercus took the strategic decision to become formally certified to ISO 9001 by the end of that year
- Having now achieved ISO 9001 accreditation, Abercus realises that this is something that could, and perhaps should, have been achieved earlier
- The purpose of this presentation is to share some of the lessons from Abercus' journey to becoming accredited, particularly from the point of view of a small company
- It is hoped that by sharing Abercus' experiences, other small companies may be encouraged to pursue a similar route towards formal ISO 9001 certification.



Introduction

Lesson 1

Take the first positive step and formally make the business decision to become ISO 9001 certified

Operating a quality system designed *in line* with ISO 9001 is not the same as being ISO 9001 certified

The process of being interrogated by an independent assessor necessarily requires the company to consider ISO 9001 in its entirety, and in Abercus' own experience a certified QMS is likely to be more robust than an in-house QMS designed in line with an understanding of ISO 9001 that may be incomplete.

**ISO 9001 certification is not just for big companies
– it's for small companies too!**



Introduction

- QMS – quality management system
- QSS – quality system supplement (by NAFEMS)
- SDM – simulation data management
- IMS – integrated management system
- JET – job execution tool (an SDM tool, by Abercus).



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ISO 9001 and NAFEMS QSS

- The ISO 9000 family of standards provide guidance and tools for companies/organizations that want to ensure that their products/services consistently meet customers' requirements and that quality is **continually improved**
- There are three standards:
 - ISO 9000 covers the basic concepts of quality management and the associated language
 - ISO 9001 sets out the requirements of a QMS
 - ISO 9004 focuses on how to make a QMS more efficient and effective
 - (The ISO 9002 and 9003 standards were incorporated into the ISO 9001 standard in 2000.)
- ISO 9001 is the only standard in the series for which companies can achieve certification.



ISO 9001 and NAFEMS QSS

- The ISO 9000 and 9001 standards were first released in 1987 and were most recently updated in 2015
- Companies certified against the previous version of ISO 9001 (released in 2008) have a three-year window in which to adapt their QMS to bring them in line with the 2015 standard
- Abercus is certified against ISO 9001:2008 and plans to update to the 2015 standard by the end of 2017.



ISO 9001 and NAFEMS QSS

- The ISO 9000 series is based upon eight principles:
 - Customer focus
 - Leadership
 - Involvement of people
 - Process approach
 - System approach to management
 - Continual improvement
 - Factual approach to decision making
 - Mutually beneficial supplier relations.



ISO 9001 and NAFEMS QSS

ISO 9001:2008

4 QMS

- 4.1 General requirements
- 4.2 Document requirements

5 Management responsibility

- 5.1 Management commitment
- 5.2 Customer focus
- 5.3 Quality policy
- 5.4 Planning
- 5.5 Responsibility, authority and communication
- 5.6 Management review

6 Resource management

- 6.1 Provision of resource
- 6.2 Human resources
- 6.3 Infrastructure
- 6.4 Work environment

7 Product realisation

- 7.1 Planning of product realisation
- 7.2 Customer-related requirements
- 7.3 Design and development
- 7.4 Purchasing
- 7.5 Production and service provision
- 7.6 Control of monitoring and measuring devices

8 Measurement, analysis and improvement

- 8.1 General
- 8.2 Monitoring and measurement
- 8.3 Control of non-conforming product
- 8.4 Analysis of data
- 8.5 Improvement



ISO 9001 and NAFEMS QSS

- The ISO 9000 standards are necessarily general – they have been designed to be used by any business, in any industry sector, in any part of the world
- Since 1989, NAFEMS has published and maintained a quality system supplement (QSS) to ISO 9001 which interprets the requirements of the ISO standard in the particular context of engineering simulation
- The NAFEMS analysis management working group (AMWG) is currently revising the QSS to bring it in line with ISO 9001:2015.



ISO 9001 and NAFEMS QSS

- To complement the formal QSS document, NAFEMS has also published a supporting *primer* document, designed to assist in the development and implementation of a quality management system for engineering simulation
- Another NAFEMS document which focuses upon quality assurance procedures for engineering analysis
 - This was published in 1999 to supplement the 1994 version of ISO 9001 and, while it has not been kept up to date, Abercuss found this to be an extremely valuable resource
 - In particular, Appendix D of this document includes a set of rudimentary example forms which can be used as a starting point for a QMS
 - (Note that the forms in Appendix D have an FEA bias.)



ISO 9001 and NAFEMS QSS

- **The NAFEMS QSS**

Engineering simulation, Quality management systems, requirements, Quality system supplement NAFEMS QSS:2008, 2014

(https://www.nafems.org/publications/browse_buy/browse_by_topic/qa/nafems_qss_2008_/)

- **The NAFEMS QSS primer**

Quality management in engineering simulation, a primer for NAFEMS QSS, NAFEMS R0116, 2014

(https://www.nafems.org/publications/browse_buy/browse_by_topic/qa/nafems_qss_primer_2014_-_r0116/)

- **QA procedures for engineering analysis**

NAFEMS quality assurance procedures for engineering analysis, NAFEMS R0064, 1999

(https://www.nafems.org/publications/browse_buy/browse_by_topic/qa/r0064/).



ISO 9001 and NAFEMS QSS

Lesson 2

If you haven't already done so, download the latest revision of the NAFEMS QSS and its associated primer from the NAFEMS website – they're free to all NAFEMS members. Also look for the quality assurance procedures for engineering analysis – the sample forms in Appendix D are worth reviewing.



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Assessors and consultants

- Having set the goal of achieving formal certification by the end of 2015, the first step was to appoint an ISO 9001 assessor
- At our first meeting, Abercus learned that the assessor cannot also be engaged in the development of the QMS, since this could represent a conflict of interest
- Whilst the team at Abercus had collective experience of working within a number of different ISO 9001 certified QMSs over the past 20 years, we chose to appoint a separate independent consultant to assist in the development of the Abercus QMS.



Assessors and consultants

- The appointment of an independent consultant was certainly worthwhile, and Abercus' certification would not have been achieved as speedily without their support
 - It was not essential – Abercus' pre-certification QMS already incorporated most of the requirements of ISO 9001
 - There is no substitute for experience and without engaging a separate consultant the journey towards formal certification would have taken longer and would have been more tentative
 - Uncertainty about the unknown is the issue – something could be missed when interpreting the ISO 9001 standard.
- Whilst there was a financial overhead associated with the appointment of the ISO 9001 consultant, it saved us in the long run and we had the peace of mind that our QMS was compliant ahead of the formal assessment.



Assessors and consultants

Lesson 3

Unless you already have experience of successfully implementing a certified ISO 9001 quality system, consider appointing an external independent ISO 9001 consultant to support the QMS development activities.



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High-level and low-level

- ISO 9000 covers two aspects: high level managerial activities and lower level technical activities.
- Abercus' pre-certification QMS had concentrated on the technical aspects of the system, using simulation data management (SDM) tools to automate CFD/FEA workflows
- It had not captured some of the managerial aspects.



High-level and low-level

- Many ISO 9001 consultancies (including those engaged by Abercus) offer an off-the-shelf quality manual and core procedures documents and templates which can be used as the starting point for a certified QMS
- These systems are quite general and tend to focus on the high level managerial aspects
- The certified Abercus QMS is a consolidation of our technical pre-certification QMS and a customised version of an off-the-shelf system covering the high level managerial aspects
- Actually, Abercus' system is an IMS – this allows for future expansion to capture environmental management (ISO 14001) and health and safety (ISO 18001).



High-level and low-level

Quality policy statement

Abercus is committed to providing consistent, reliable and flexible services that meet the needs of customers, and to continually improve the business based upon customer feedback.

Our quality commitments

We will demonstrate our commitment to quality by:

- providing a focus on customer requirements
- compliance with legal and other relevant requirements
- actively engaging in a programme of continuous improvement of the management system to ensure its continuing suitability and effectiveness.

Our quality objectives

Our objectives will be delivered through a program of quality targets.

- monitoring and improving the satisfaction of our customers
- managing our processes carefully to maximize the benefits to our clients
- adoption of best practice in our activities
- train and develop personnel to increase their understanding, efficiency and competency
- the identification and management of critical and business activities
- development and maintenance of a quality management system conforming to ISO 9001.

Who is this policy statement for?

Copies of this quality policy statement will be made freely available to all those with an interest. This statement will be promoted to employees, customers and representatives of the local communities in which we operate.



IMS Manual

Content

		Page	ISO 9001:2008 / NAFEMS QSS:2008 clause
	Company profile and scope	3	
	Purpose of this manual	4	
	References and definitions	5	3

Reference	Core IMS elements	Page	ISO 9001: 2008 clause
C/1	Introduction	6	
C/2	Policy Statement	6	5.1, 5.3, 8.5
C/3	Objectives, Targets and Management Programmes	6	5.4.1
C/4	Structure and Responsibility	7	5.1, 5.5.1-2, 6.1, 6.3, 6.2.1, 6.4
C/5	Training, Awareness and Competence [CP 04]	7	6.2.1, 6.2.2
C/6	Communication	8	5.5.3, 7.2.3
C/7	Documentation	8	4.2.2
C/8	Document and Data Control [CP 01]	8	4.2.3
C/9	Supplier Assessment and Contractor Control	8	7.4.1
C/10	Approval of New Services, Installations and Equipment	8	5.4.2
C/11	Monitoring, Measurement and Testing	8	7.6, 8.1, 8.2.1, 8.2.3, 8.2.4, 8.4
C/12	Non-conformance, Corrective and Preventative Action [CP 03]	8	8.3, 8.5.2-3
C/13	Records [CP 01]	9	4.2.4
C/14	Audit [CP 05]	9	8.2.2
C/15	Management Review [CP 05]	9	5.6

Reference	Quality specific elements	Page	ISO 9001: 2008 clause
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Q/2	Quality Planning	10	5.1, 5.2, 5.4.2, 6.1, 6.3, 7.1, 7.5.2
Q/3	Customer Related Processes	10	7.2.1, 7.2.2
Q/4	Design and Development	10	7.3
Q/5	Purchasing	11	7.4
Q/6	Serviceion and Service Provision	11	7.5
Q/7	Control of Measuring and Monitoring Equipment	12	7.6
Q/8	Control of Service Nonconformity [CP 03]	12	8.3
Q/9	Mandatory quality records	12	4



IMS Manual

High-level and low-level

CORE IMS ELEMENTS

C/1 INTRODUCTION

This section of the manual describes those elements of the IMS that are core to quality management. These common elements are represented by a C/number and address specific clauses in the standard listed in the purpose section. Please note the current certification extends to quality only, however provision has been made for safety and the environment should the need arise.

Core procedures (C/numbers) are used where possible in the management system to stream-line systems and reduce documentation for example where two standards may have a similar requirement.

Specific topics are represented by Q/number for Quality, E/numbers for Environment and S/numbers for Safety.

C/2 POLICY STATEMENTS

Abercus has a quality policy statement and a health and environmental statement in place which describe commitments to act responsibly to our customers, our people, our neighbours and the environment ([BPS-001] and [BPS-002] respectively).

We are committed to customer satisfaction, prevention of pollution, legal compliance and continual improvement in all areas of our services, processes and activities.

C/3 OBJECTIVES, TARGETS AND MANAGEMENT PROGRAMMES

We have established and maintain a management programme that incorporates objectives and targets. Objectives are described in the policy (C/2) and are derived from the mission statement and from consideration of regulatory requirements (C/3) and business risks.

Objectives are broad organisation wide goals framed within the context of the policy statements while targets are measurable, responsibilities are defined and time-scales set. In order to ensure full understanding among colleagues of the objectives and targets these are communicated at least annually. In order to ensure the targets are progressing according to plan management programmes are produced containing project milestones,



High-level and low-level

Conformance audit of IMS against ISO 9001:2008

CLAUSE	REQUIREMENT	DOCUMENTS WITHIN IMS			
		Manual	Procedure	Work Instruction	Other
5	MANAGEMENT RESPONSIBILITY				
5.1	MANAGEMENT COMMITMENT				
	Has top management provided evidence of its commitment to the development and implementation of the quality management system and continually improving effectiveness:				
a)	communicating to the organisation the importance of meeting customer as well as statutory and regulatory requirements?				
b)	establishing the quality policy?				
c)	ensuring that quality objectives are established?				
d)	conducting management reviews?				
e)	ensuring the availability of resources?				

CLAUSE	REQUIREMENT	DOCUMENTS WITHIN IMS			
		Manual	Procedure	Work Instruction	Other
5.6	MANAGEMENT REVIEW	C/15	CP 05		
5.6.1	GENERAL				
R	Is top management reviewing the quality management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness?				
	Does the review include assessing opportunities for improvement and the need for changes to the quality management system, including quality policy and quality objectives?				
	Are the records from management reviews maintained (see 4.2.4)?				
		---	---	---	---
	5.6.2 REVIEW INPUT	-	CP 05	-	
	Does the input to management review include information on:				
	a) results of audits?				
	b) customer feedback?	-	CP 05	-	
	c) process performance and product conformity?	-	CP 05	-	
	d) status of preventive and corrective actions?	-	CP 05	-	
	e) follow-up actions from previous management reviews?	-	CP 05	-	
	f) planned changes that could affect the quality management system?	-	CP 05	-	
	g) recommendations for improvement?	-	CP 05	-	
		---	---	---	---

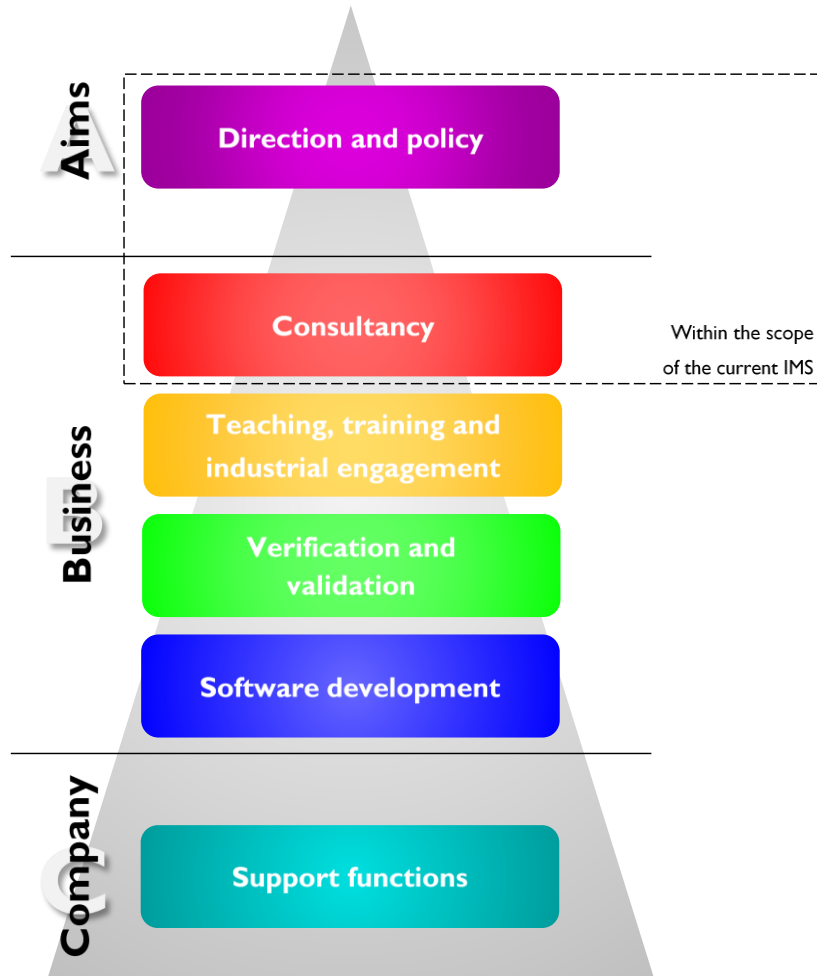


High-level and low-level

- Some of these managerial aspects, with hindsight, now seem obvious
- For example, the formalisation of a business map
 - Abercus had operated its business for five years without formalising exactly what the company does. The process of formalising our activities provided the opportunity to review and question our business activities, and this has led to a new data structure underlying the whole of the business.

High-level and low-level

BUSINESS MAP



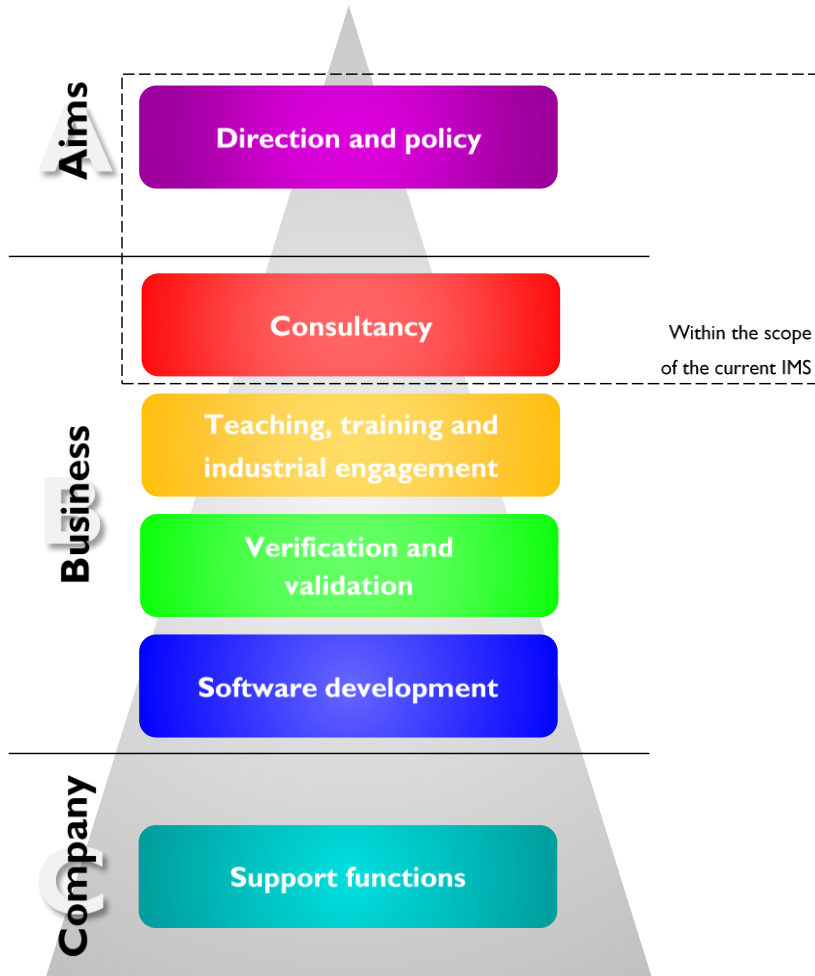
BUSINESS MODEL



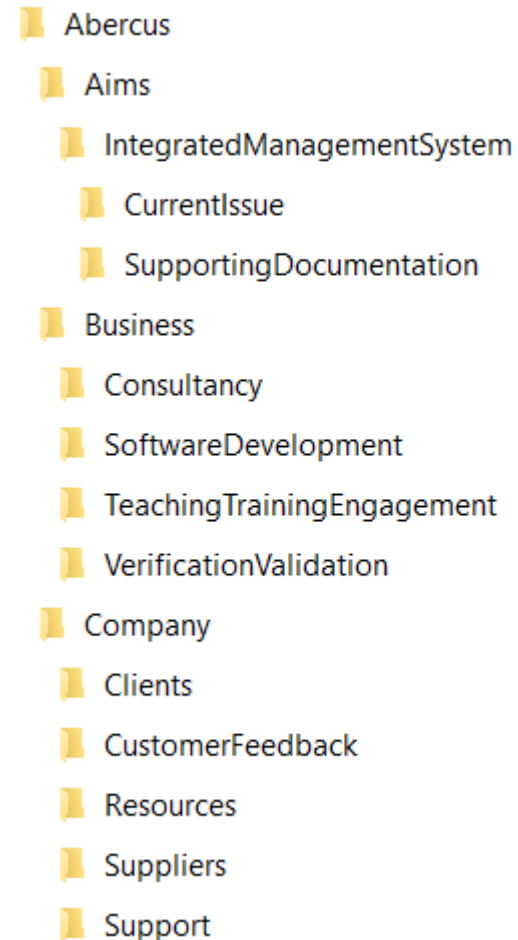


High-level and low-level

BUSINESS MAP



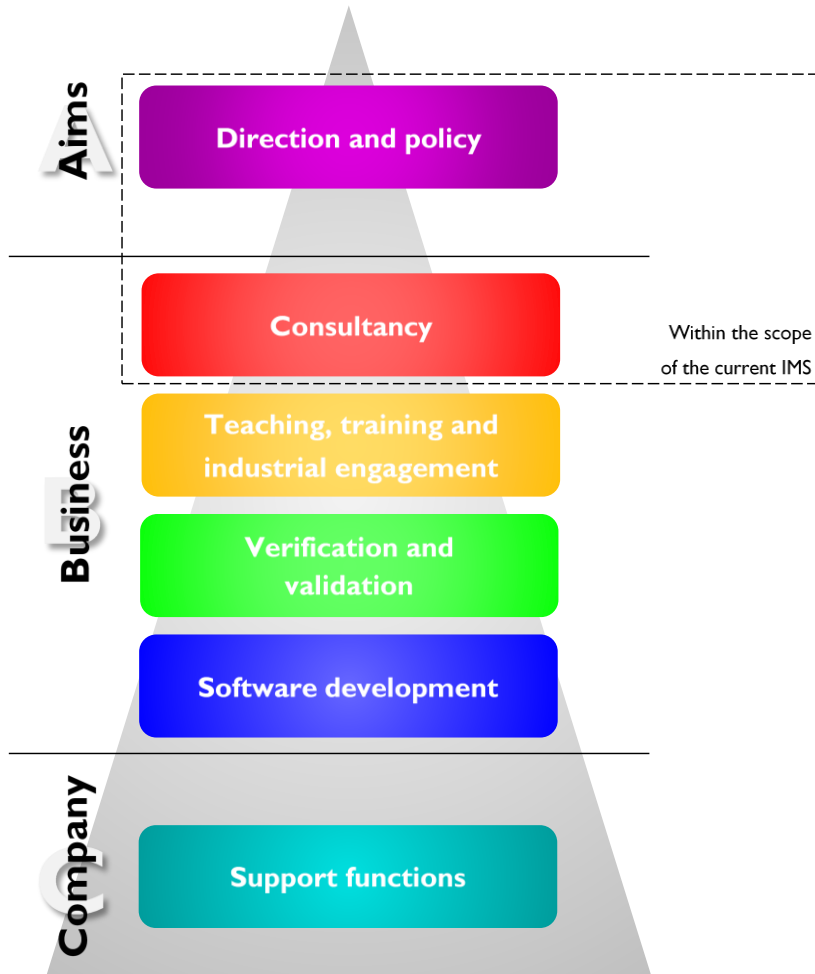
BUSINESS STRUCTURE



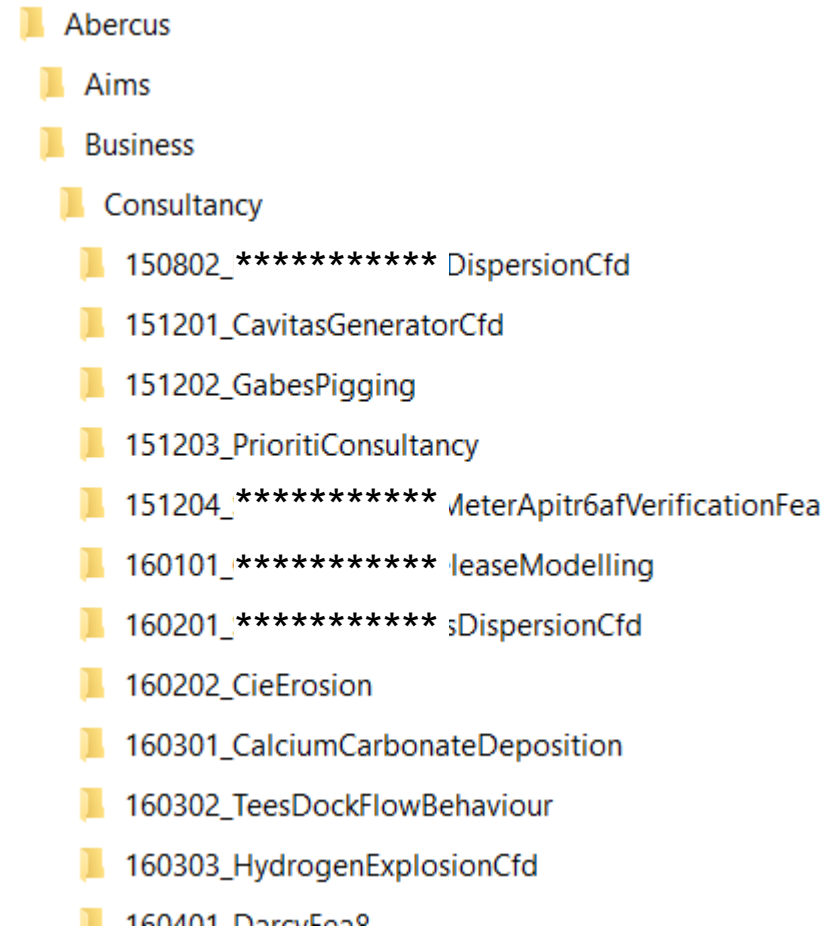


High-level and low-level

BUSINESS MAP



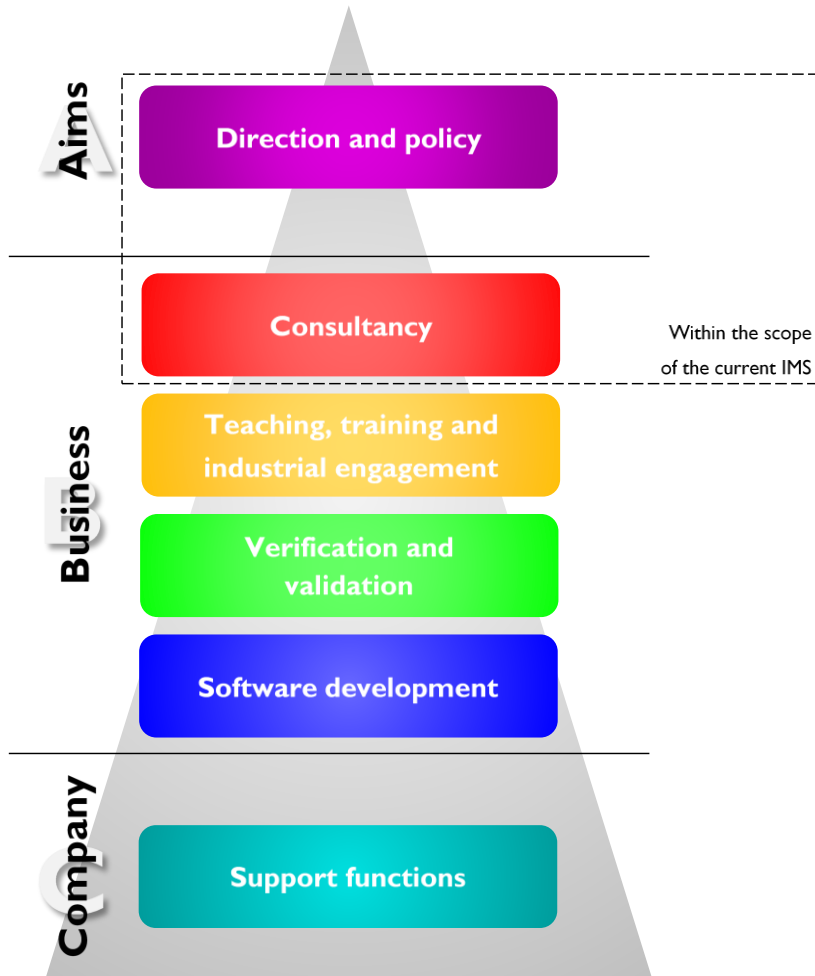
BUSINESS STRUCTURE



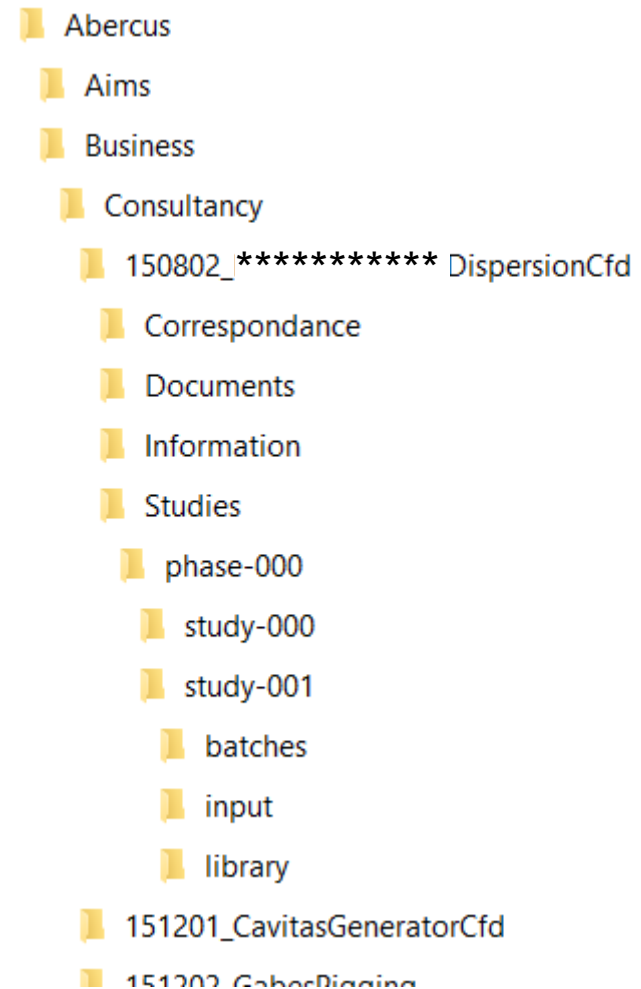


High-level and low-level

BUSINESS MAP

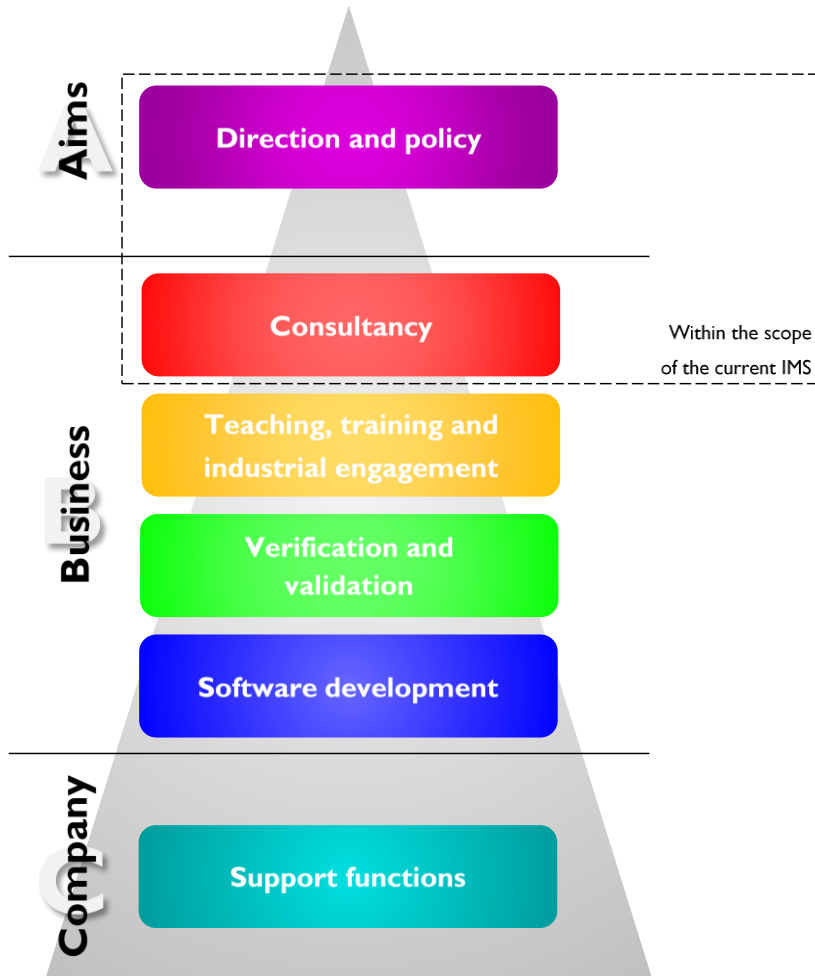


BUSINESS STRUCTURE



High-level and low-level

BUSINESS MAP



BUSINESS STRUCTURE

- Abercus
 - Aims
 - Business
 - Consultancy
 - SoftwareDevelopment
 - TeachingTrainingEngagement
 - TT150901_IntroductionToCfdForSubseaEngineering
 - TT151201_*** nFlowAssuranceCourse
 - TT151202_NafemsUkTelford
 - TT160101_***** ProbabilisticCfdFea
 - TT160102_ErcoftacOilAndGas
 - TT160201_BenchmarkHpc
 - TT160301_NafemsCfdPrimer
 - TT160302_NsriSubseaStorage
 - TT160501_NafemsCfdV&v
 - TT160502_BenchmarkAmwg
 - TT160503_Fluid201605



High-level and low-level

Lesson 4

Formalise a business map – capturing and understanding the current practices within the business is the first step in improving those practices.

One of the underlying principles of ISO 9001 is that of continual improvement. Without knowing where the business is currently, it is impossible to improve effectively.



High-level and low-level

- NAFEMS QSS has simulation specific requirements, including a risk assessment:
 - Vital
 - Important
 - Advisory
- May influence what is fit for purpose, and the level of validation activity that is undertaken.



High-level and low-level

- ASME and NAFEMS have published a *What is?* guide that is freely available:

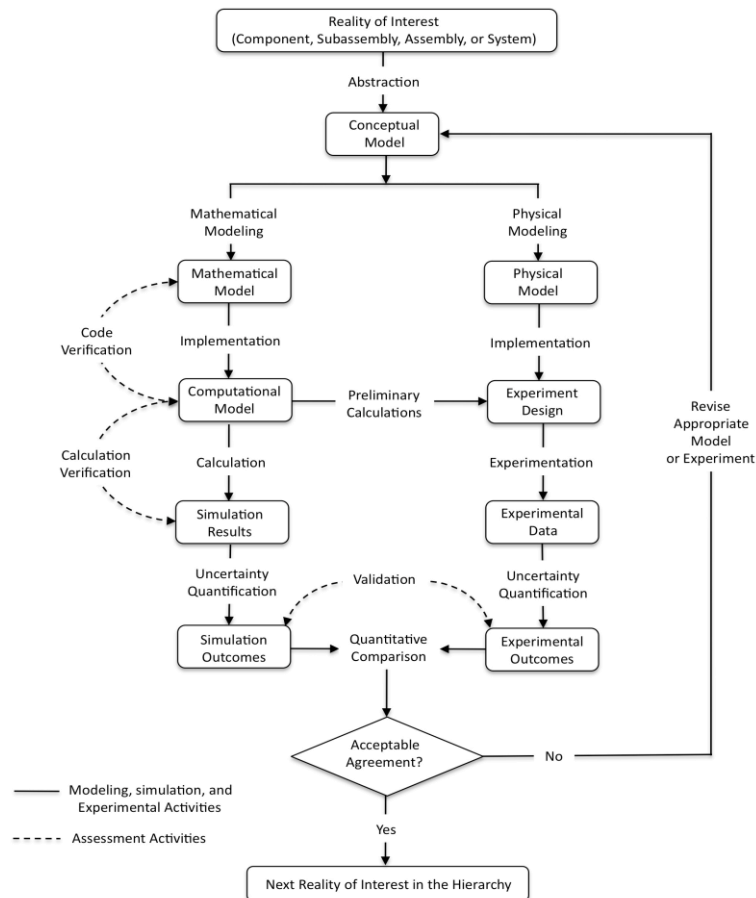
http://www.nafems.org/publications/browse_buy/browse_by_topic/qa/verification_and_validation/





High-level and low-level

VERIFICATION AND VALIDATION

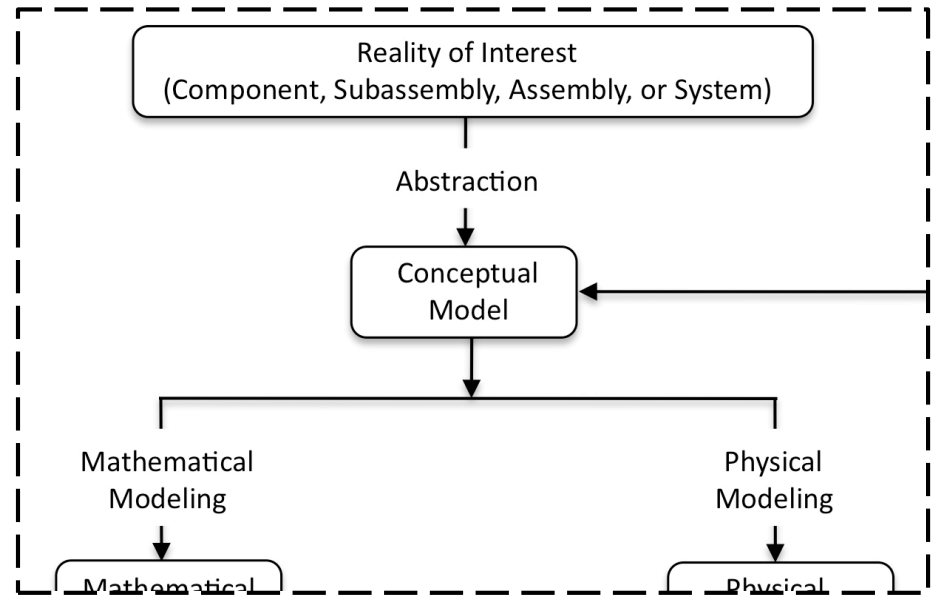
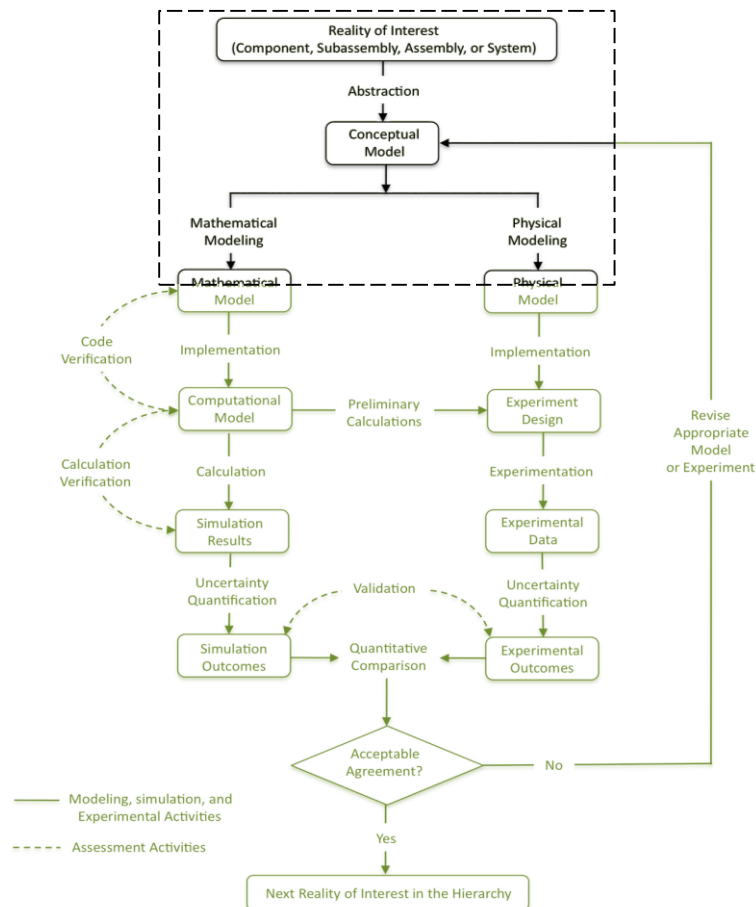


From ASME/NAFEMS *What is?* Guide.



High-level and low-level

VERIFICATION AND VALIDATION

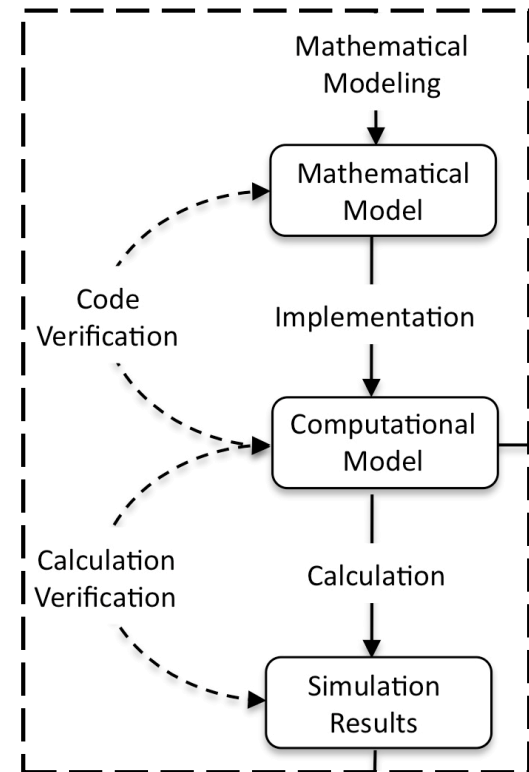
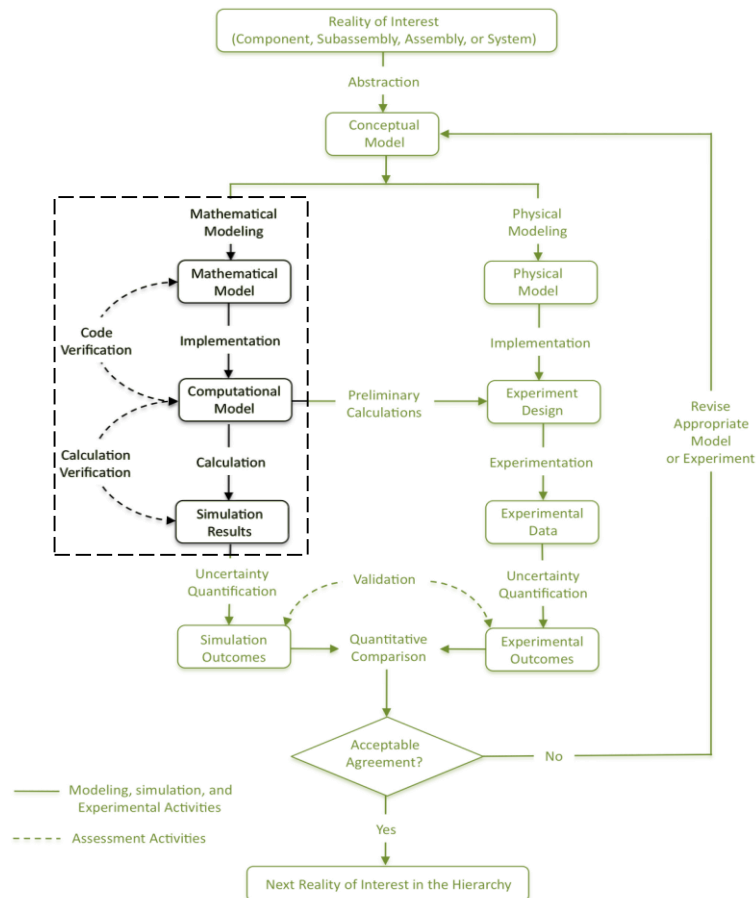


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High-level and low-level

VERIFICATION AND VALIDATION

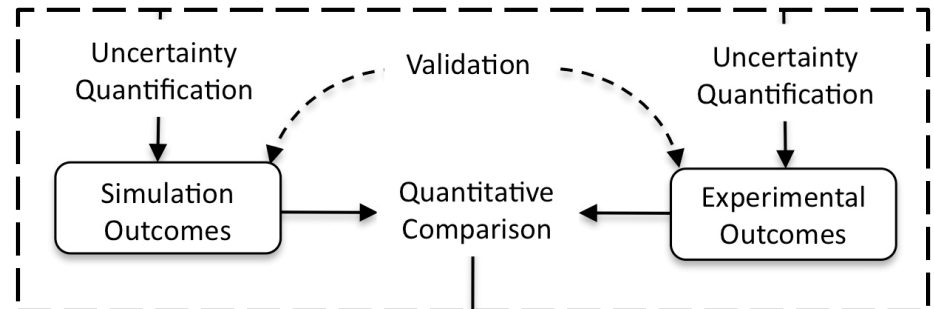
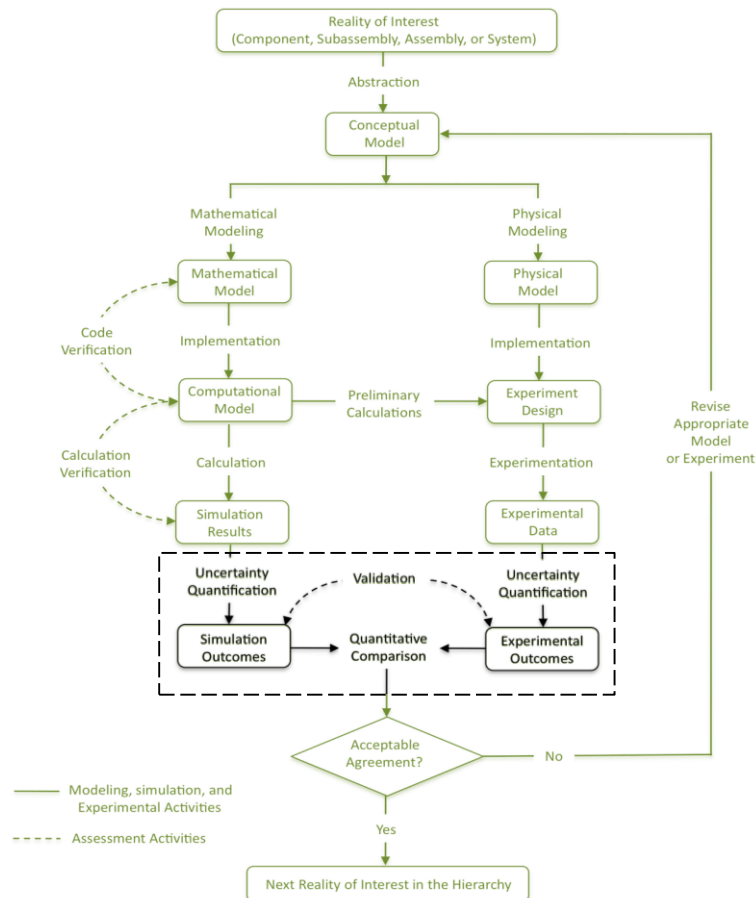


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High-level and low-level

VERIFICATION AND VALIDATION



From ASME/NAFEMS *What is?* Guide.



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Saving time/effort at point of use

- The completion of QMS records to document the details of engineering simulations is essential to allow projects to be revisited
- However, this often constitutes a separate additional physical task which can be perceived negatively since it can distract from the immediate task of getting a simulation running
- A successful QMS should be designed to save time and effort at the point of use.



Saving time/effort at point of use

- Engineering simulation is well suited to process automation and the use of SDM tools
- Every simulation undertaken within Abercus is scripted so that a precise record of the simulation is stored
 - Each simulation is run as a background process without needing to interact with the GUI of the simulation tool
 - Abercus uses JET, an in-house SDM tool that was originally developed in 2002 to automatically create the simulation scripts
 - Over the years, the use of JET has saved time and effort at the point of use – the act of entering simulation specific information into JET to create the simulation scripts also acts to provide the information required for the QMS record, minimising duplication of effort
 - Work is consistent, efficient, and follows a validated workflow.



Saving time/effort at point of use

JET – AN SDPM TOOL

Select Project Type

☐ Bid
☒ Commercial
☐ Research

Close Form

Projects Phases Studie

First Project

ProjectID:
Project description:
Project directory:

ProjectID:
Project description:
Project directory:

ProjectID:
Project description:
Project directory:

Select Project Type

☐ Bid
☒ Commercial
☐ Research

Close Form

Projects Phases Studies

First Study

Previous Study

Next Study

Last Study

Add New Study

StudyID: 001

MobyID: 6

Select Study Type: Plume-Dispersion

Study description: Dispersion study for well testing

[View Study Details](#)

/150802/000/001

StudyID: 000

MobyID: 6

Select Study Type: Plume-Dispersion

Study description: Dispersion study for well testing, demonstration

[View Study Details](#)

/150802/000/000



Saving time/effort at point of use

JET – AN SDPM TOOL

ProjectID:	150802	***** CFD dispersion study				Software				Close Form
PhaseID:	000					Models:	nsys-wb-14.0	Cases:	fluent-3D-14.0	
StudyID:	001	Dispersion study for well testing				Domains:	gambit-2.0	Runs:	fluent-3D-6.0.19	
MobyID:	6					Meshes:	mgrid-0.0.0	Plots:	fluent-3D-6.0.19	
StudyType:	Plume-Dispersion									

Models Domains Meshes Cases Runs Plots

First Model	Previous Model	Next Model	Last Model	Add New Model	Copy Model	Create Model
Model: model-002						
Starting Model: ProjectType: ProjectID: PhaseID: StudyID: ModelID:						
Commerical project-150 phase-000 study-000 model-001						
Model description: 0.33m radius patch, refined mesh around derrick						
Comments: <input type="checkbox"/> CanEdit						
Analyst: Steve Howell Creation Date: 09/11/2015 11:55:25						
Model: model-001						
Starting Model: ProjectType: ProjectID: PhaseID: StudyID: ModelID:						
Commerical project-150 phase-000 study-000 model-000						

Sessions for model-002: CurrentModelID: 2

New session		Run session	
000	<input type="checkbox"/> CanEdit	Analyst: Steve Howell	09/11/2015 11:55:27
		ModelSaved: <input checked="" type="checkbox"/>	ModelExported: <input checked="" type="checkbox"/> 09/11/2015 16:20:44
001	<input type="checkbox"/> CanEdit	Analyst: Steve Howell	09/11/2015 18:19:53
		ModelSaved: <input checked="" type="checkbox"/>	ModelExported: <input checked="" type="checkbox"/> 09/11/2015 19:12:06



Saving time/effort at point of use

JET – AN SDPM TOOL

ProjectID: 150802 ***** 1

PhaseID: 000

StudyID: 001 Dispersion study

MobyID: 6

StudyType: Plume-Dispersion

Models Domains Meshes Cases R

First Domain Previous Domain Next Domain

Domain: domain-003

Starting Domain: /project-150802

Starting Domain: ProjectType: F Commercial p

Domain description: Wind from 2

Analyst: Steve Howel

Domain: domain-002

Starting Domain: /project-150802

Starting Domain: ProjectType: F

domain-003.jou - Notepad

File Edit Format View Help

```
/-----  
/Journal created 16/11/2015 21:23:54 by Steve Howell  
/Journal to run with gambit-2.0 software  
/Created with Moby, Version 0.0.6  
/-----  
/  
/-----  
/Define input parameters  
/-----  
/  
/domain name  
$domainName = "domain-003.msh"  
/  
/sw000 settings  
$geo_windAngle = 270  
$geo_xOrigin = 25  
$geo_yOrigin = -25  
$geo_baseElevation = 11  
$geo_models_xLength = 450  
$geo_models_yLength = 150  
$geo_models_height = 109  
$geo_domain_length = 1500  
$geo_domain_width = 800  
$geo_domain_windLeeFraction = 0.4  
$geo_domain_height = 389  
$msh_models_horizontal = 10  
$msh_iface_lowerInitLength = 2  
$msh_iface_lowerAvgLength = 4  
$msh_domain_upperInitLength = 6  
$msh_domain_upperAvgLength = 10  
$szf_startLength = 10  
$szf_growthRate = 1.05  
$szf_radius = 10000  
$szf_maxLength = 50  
/  
/-----  
/Write standard section of journal  
/-----  
/  
/Calculate variables  
/  
  Geometry  
  $models_windward = $geo_xOrigin - ($geo_models_xLength/2)  
  $models_leeward = $geo_xOrigin + ($geo_models_xLength/2)  
  $models_leftward = $geo_yOrigin - ($geo_models_yLength/2)
```

Close Form

CurrentDomainID: 3

	270
	25
	-25
	11
	450
	150
	109
	1500
	800
raction	0.4
	389
	10



Saving time/effort at point of use

JET – AN SDPM TOOL

ProjectID:	150802 ***** CFD dispersion study	Software		Close Form
PhaseID:	000	Models:	nsys-wb-14.0 ▾ Cases: fluent-3D-14.0 ▾	
StudyID:	001 Dispersion study for well testing	Domains:	gambit-2.0 ▾ Runs: fluent-3D-6.0.19 ▾	
MobyID:	6	Meshes:	mgrid-0.0.0 ▾ Plots: fluent-3D-6.0.19 ▾	
StudyType:	Plume-Dispersion ▾			

Models Domains Meshes Cases Runs Plots

First Mesh	Previous Mesh	Next Mesh	Last Mesh	Add New Mesh	Copy Mesh	Create Mesh
Mesh: <input type="checkbox"/> CanEdit	mesh-007					
Mesh description:	Gauge tank vent, 450x150model, wind wind from 270					
Analyst:	Steve Howell ▾		Creation Date: 16/11/2015 21:26:36			
Mesh: <input type="checkbox"/> CanEdit	mesh-006					
Mesh description:	Four vents patched at end of burner boom, 450x150model, wi					
Analyst:	Steve Howell ▾		Creation Date: 16/11/2015 19:35:29			
Mesh: <input type="checkbox"/> CanEdit	mesh-005					
Mesh description:	0.33m patch, refined mesh around derrick, 450x150model, wir					
Analyst:	Steve Howell ▾		Creation Date: 16/11/2015 10:28:15			
Mesh: <input type="checkbox"/> CanEdit	mesh-004					
Mesh description:	0.33m patch, refined mesh around derrick, 600x200model, wir					

Settings for mesh-007: CurrentMeshID: ☐ 7

Domain:	domain-003 ▾	<input type="checkbox"/> FuseInterfaces
Interface, Model:	model-007 ▾	Boundary: model_interface ▾
ProjectID	PhaseID	StudyID
MeshID	CaseID	RunID_

Models for mesh-007:

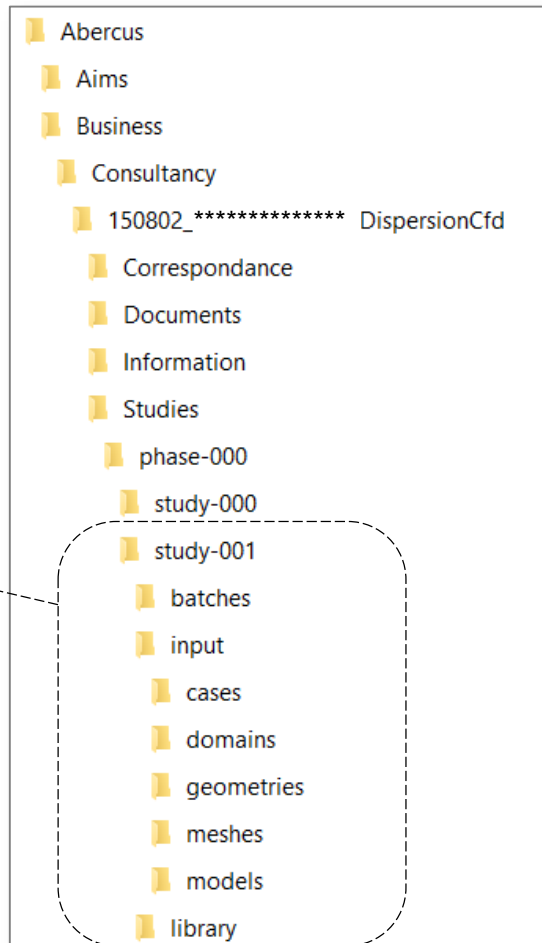
Add model	Remove Model
<input type="checkbox"/> ▾	
000 model-007 Gauge tank vent, 450x150 extents	



Saving time/effort at point of use

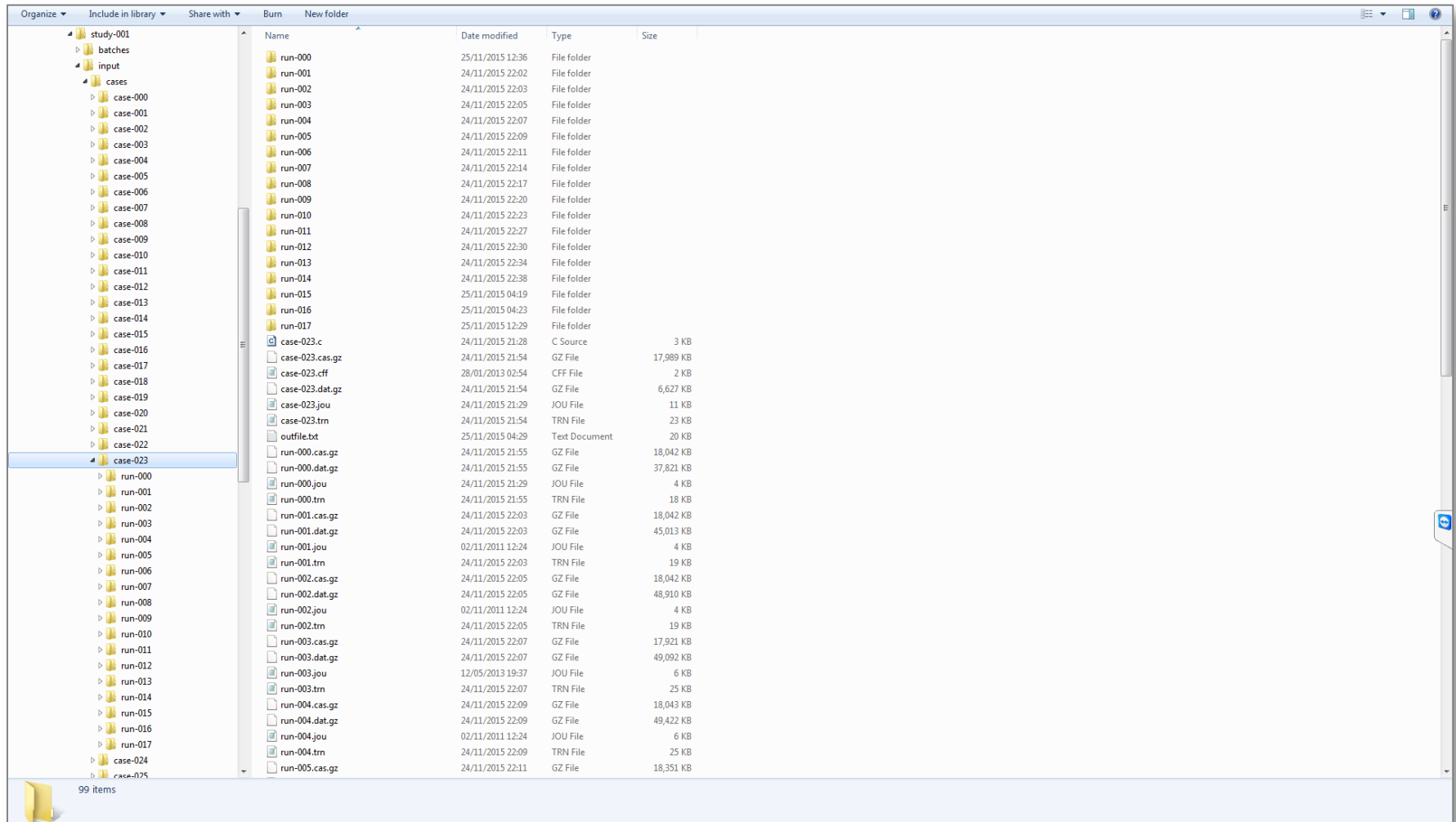
JET – AN SDPM TOOL

Underlying file structure
is automatically created



Saving time/effort at point of use

JET – AN SDPM TOOL



JET – AN SDPM TOOL

```

case-023-j20 - Netepd
File Edit Format View Help

yes incompressible-ideal-gas ;--density
yes constant 1006.43 ;--specific heat
yes constant 0.0242 ;--thermal conductivity
yes constant 1.7894E-5 ;--viscosity
yes 28.966 ;--molecular weight
no ;--thermal expansion coefficient
no ;--speed of sound
no

/define/materials/change-create/fluid-template none hydrocarbon-gas
yes incompressible-ideal-gas ;--density
yes constant 2222.0 ;--specific heat
yes constant 0.0332 ;--thermal conductivity
yes constant 1.087E-5 ;--viscosity
yes 16.22 ;--molecular weight
no ;--thermal expansion coefficient
no ;--speed of sound
no

/define/materials/change-create/mixture-template gas-mixture
yes 2 hydrocarbon-gas ambient-air 0 0 ;--species
yes incompressible-ideal-gas ;--density
yes mixing-law ;--specific heat
yes mass-weighted-mixing-law ;--thermal conductivity
yes mass-weighted-mixing-law ;--viscosity
yes multicomponent constant 1.6489E-5 ;--mass diffusivity
no ;--thermal diffusion coefficient
no ;--speed of sound
no

---thermal diffusion coefficient (via GUI)
(cx-gui-do cx-activate-item "NavigationPane*Frame1*PushButton4(Materials)")
(cx-gui-do cx-set-list-selections "Materials*Frame1*Table1*Frame1*List1(Materials)" "( 1)")
(cx-gui-do cx-activate-item "Materials*Frame1*Table1*Frame1*List1(Materials)")
(cx-gui-do cx-activate-item "Materials*Frame1*Table1*Frame2*Button8ox2*PushButton1(Create/Edit)")
(cx-gui-do cx-set-list-selections "Create/Edit Materials*Frame2(Properties)*Table2(Properties)*Frame10*Frame2*DropDown1(Create/Edit Materials*Frame2(Properties)*Table2(Properties)*Frame10*Frame2*DropDownList:Thermal Diffusion Coefficients*Frame2*RealEntry3" "( 1.0E-5)")
(cx-gui-do cx-activate-item "Thermal Diffusion Coefficients*PanelButtons*PushButton3(OK)")
(cx-gui-do cx-activate-item "Create/Edit Materials*PanelButtons*PushButton1(Change/Create)")
(cx-gui-do cx-activate-item "Create/Edit Materials*PanelButtons*PushButton1(Close)")

/define/models/species/species-transport? yes gas-mixture

-----
: set cell-zone conditions
-----
: general
/define/boundary-conditions/fluid fluid mixture yes gas-mixture no no no 0.0 no 0.0 no 0.0 no 0.0 no 1.
/define/boundary-conditions/fluid fluid 0 mixture yes gas-mixture no no no 0.0 no 0.0 no 0.0 no 0.0 no 0.0 no

: set boundary conditions
-----
: domain
/define/boundary-conditions/zone-type windward velocity-inlet
/define/boundary-conditions/velocity-inlet windward no yes yes no 0.0 yes yes yes "udf" "xvel" yes yes "udf" "yvel"
/define/boundary-conditions/zone-type leeward pressure-outlet
/define/boundary-conditions/pressure-outlet leeward no 0.0 303.15 no yes yes yes yes "udf" "turbKE" yes yes "t"
/define/boundary-conditions/zone-type domain-base wall
/define/boundary-conditions/wall domain-base 0.0 no no no 0.0 no no no 1.5E-03 no 0.5 yes
/define/boundary-conditions/zone-type model_sea wall
/define/boundary-conditions/wall model_sea 0.0 no no no 0.0 no no no 1.5E-03 no 0.5 yes
/define/boundary-conditions/zone-type leftward symmetry
/define/boundary-conditions/zone-type rightward symmetry
/define/boundary-conditions/zone-type domain-sky symmetry

:---walls
/define/boundary-conditions/wall burnerboom 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes shear-burnerboom_355 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes
/define/boundary-conditions/wall cranes 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes shear-derrick 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes shear-expoequipment 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes shear-funnels 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes shear-hull 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes shear-lifeboats 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes shear-lift 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes shear-schiff
/define/boundary-conditions/wall poopdeck 0.0 no 0.0 no yes heat-flux no 0.0 no yes motion-bc-stationary yes shear-

```

Saving time/effort at point of use

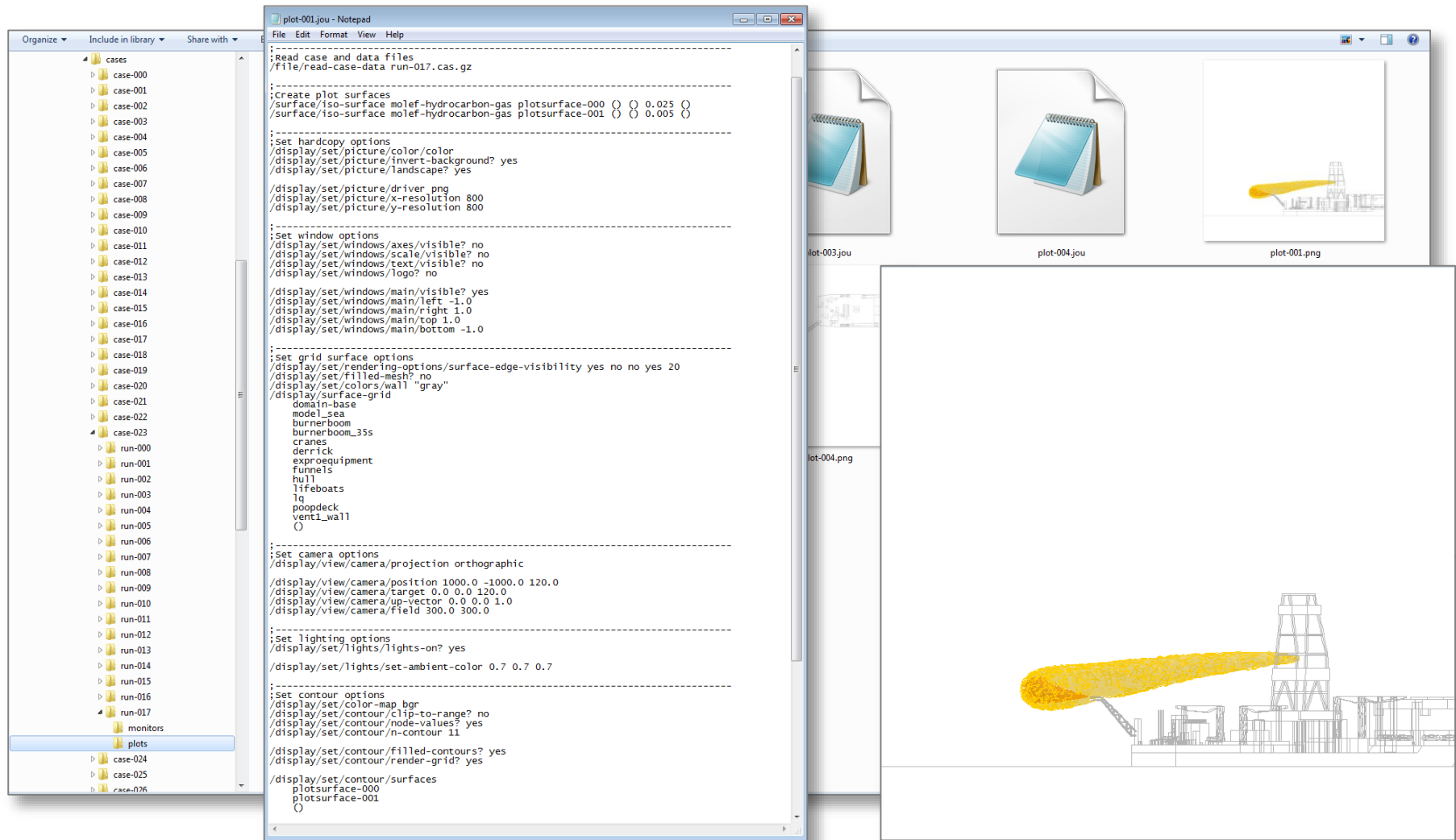
JET – AN SDPM TOOL

```
run-014.jou - Notepad
File Edit Format View Help
-----
:write all output to transcript file
/file/start-transcript "run-014.trn" yes
-----
:Read in case and data files
/file/read-case-data "run-013.cas.gz"
-----
:Set user-defined parameters
/define/user-defined/execute-on-demand "setParameters"
-----
:Set discretization scheme
/solve/set/discretization-scheme/mom 1
/solve/set/discretization-scheme/k 0
/solve/set/discretization-scheme/epsilon 0
/solve/set/discretization-scheme/temperature 0
/solve/set/discretization-scheme/pressure 10
/solve/set/discretization-scheme/species-0 1
-----
:Set under-relaxation factors
/solve/set/under-relaxation/body-force 0.8
/solve/set/under-relaxation/density 0.8
/solve/set/under-relaxation/epsilon 0.4
/solve/set/under-relaxation/k 0.4
/solve/set/under-relaxation/mom 0.7
/solve/set/under-relaxation/pressure 0.3
/solve/set/under-relaxation/species-0 0.8
/solve/set/under-relaxation/temperature 0.8
/solve/set/under-relaxation/turb-viscosity 0.8
-----
:set limits
/solve/set/limits 1.0 5.0e+10 1.0 5000.0 1.0e-14 1.0e-20 1.0e+10
-----
:solve equations
/solve/set/equations/flow yes
/solve/set/equations/ke yes
/solve/set/equations/species-0 yes
/solve/set/equations/temperature yes
-----
:check convergence
/solve/monitors/residual/check-convergence? no no no no no no no
-----
:Monitors
/solve/monitors/surface/set-monitor xmin_M5000 "Vertex Minimum" x-coordinate MonitorSurface-000 0 no no yes "run-01
/solve/monitors/surface/set-monitor xmax_M5000 "Vertex Maximum" x-coordinate MonitorSurface-000 0 no no yes "run-01
/solve/monitors/surface/set-monitor ymin_M5000 "Vertex Minimum" y-coordinate MonitorSurface-000 0 no no yes "run-01
/solve/monitors/surface/set-monitor ymax_M5000 "Vertex Maximum" y-coordinate MonitorSurface-000 0 no no yes "run-01
/solve/monitors/surface/set-monitor zmin_M5000 "Vertex Minimum" z-coordinate MonitorSurface-000 0 no no yes "run-01
/solve/monitors/surface/set-monitor zmax_M5000 "Vertex Maximum" z-coordinate MonitorSurface-000 0 no no yes "run-01
-----
:Adapt mesh
/adapt/set/grad-vol-weight 1.0
/adapt/set/max-number-cells 5000000
/adapt/set/min-cell-volume 1.0e-6
(cx-gui-do cx-activate-item "MenuBar*AdaptMenu*Controls...")
(cx-gui-do cx-set-integer-entry "Mesh Adaption Controls*Frame3*IntegerEntry(Max Level of Refine)" 10)
(cx-gui-do cx-activate-item "Mesh Adaption Controls*PanelButtons*PushButton(OK)")
/adapt/mark-with-gradients hydrocarbon-gas curvature 2 no 0.2 0.0 no 1.0e-6 0 5000000
/adapt/adapt-to-register "gradient-r0" 1.0e-6 5000000 yes
-----
:Iterate
/solve/iterate 100
```



Saving time/effort at point of use

JET – AN SDPM TOOL



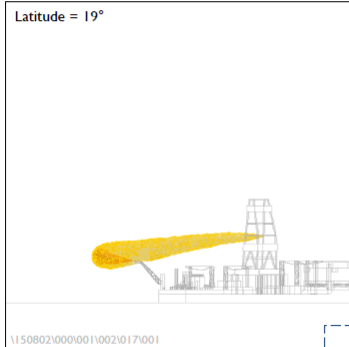


Saving time/effort at point of use

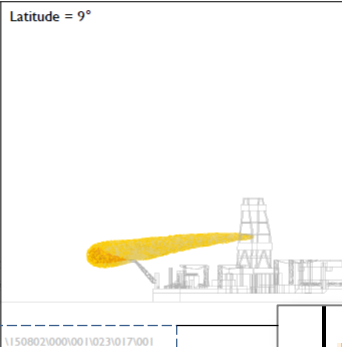
JET – AN SDPM TOOL

CFD predictions

Latitude = 19°



Latitude = 9°



Wind speed: 5.0 m/s
Wind direction: 145°
Ambient temperature: 30.0 °C
Flow rate: 45 MMscfd
Discharge: 10" relief tie-in
Vent temperature: 180 °F

Concentration of hydrocarbon

50% LEL 10% LEL

ENVELOPE PLOT FOR CONCENTRATION OF HYDROCARBON

25 Nov 2015 SR-150802-001-A ***** CFD, effect of latitude

13

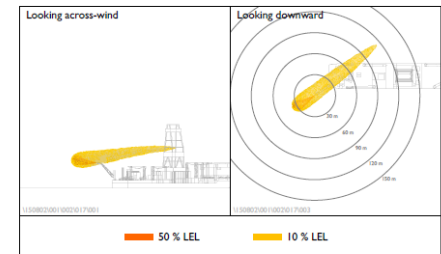
Abercus Riverside House Riverside Drive Aberdeen AB11 7LH www.abercus.com



Prepared by Abercus
Ref: *****

CFD results generated using computational modelling

Appendix



TAT: 003
Wind speed: 5.0 m/s
Wind direction: 145°
Vent scenario: 10" relief tie-in, 45.0 MMscfd @ 180 °F
Boom position: 145°

Figure C.3

TR-150802-001 Rev 0

www.abercus.com

08 January 2016



Saving time/effort at point of use

Lesson 5

Consider using an SDM tool to automate the simulation workflow. This provides a consistent framework for undertaking routine simulations whilst automatically compiling the information required for the QMS.



Agenda

- Introduction
- ISO 9001 and NAFEMS QSS
- Assessors and consultants
- High-level and low-level
- Save time and effort at point of use
- **Keep it simple**
- Summary
- Questions



Keep it simple

- The ISO 9000 standards are generic and there is no right or wrong solution – each QMS is a custom solution that is defined by the users of the QMS, since they know their own business best
- Beware of making a QMS excessively comprehensive from the start:
 - If something is included within the QMS, make sure that it does actually add value and will get done
 - Don't include any new activities within the QMS just because they seem like a good idea if they are not likely to be completed
 - If you do that, you may have unnecessarily created an opportunity for a non-compliance which could ultimately lead to the loss of certification.



Keep it simple

Lesson 6

Keep the QMS as simple as possible and ensure that it reflects the business process maps outlining the current activities within the business

Don't wait to design a perfect comprehensive QMS before trying to get certified:

- The whole point of ISO 9001 is that it's a framework for continual improvement

- The journey towards ISO 9001 certification starts from where the company is now, not from somewhere else that it would ideally like to be

- The important point is to recognise this and start on the journey towards accreditation without delay.



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Summary

- Take the strategic business decision to become ISO 9001 accredited – it's not just for big companies, it's for small companies too
- Make full use of your NAFEMS membership and download the QSS, the QSS primer and the sample forms from the QA procedures (1999)
- Unless you already have experience of ISO 9001, consider appointing an external consultant to support the QMS development activities
- Formalise a business map
- Consider using an SDM tool to automate
- Keep the QMS as simple as possible, and don't wait to design a perfect comprehensive QMS.



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Questions

- Abercus is ISO 9001 accredited and its system is in line with the NAFEMS QSS. Is it possible to achieve formal NAFEMS QSS accreditation too?
- The NAFEMS AMWG is currently updating the QSS and associated primer to bring it in line with the 2015 version of ISO 9001. Would it be a good idea to bring the 1999 document up to date too? Possibly as a sample QA system? (Which could be written as a simple SDM database to create simple simulation scripts.)

