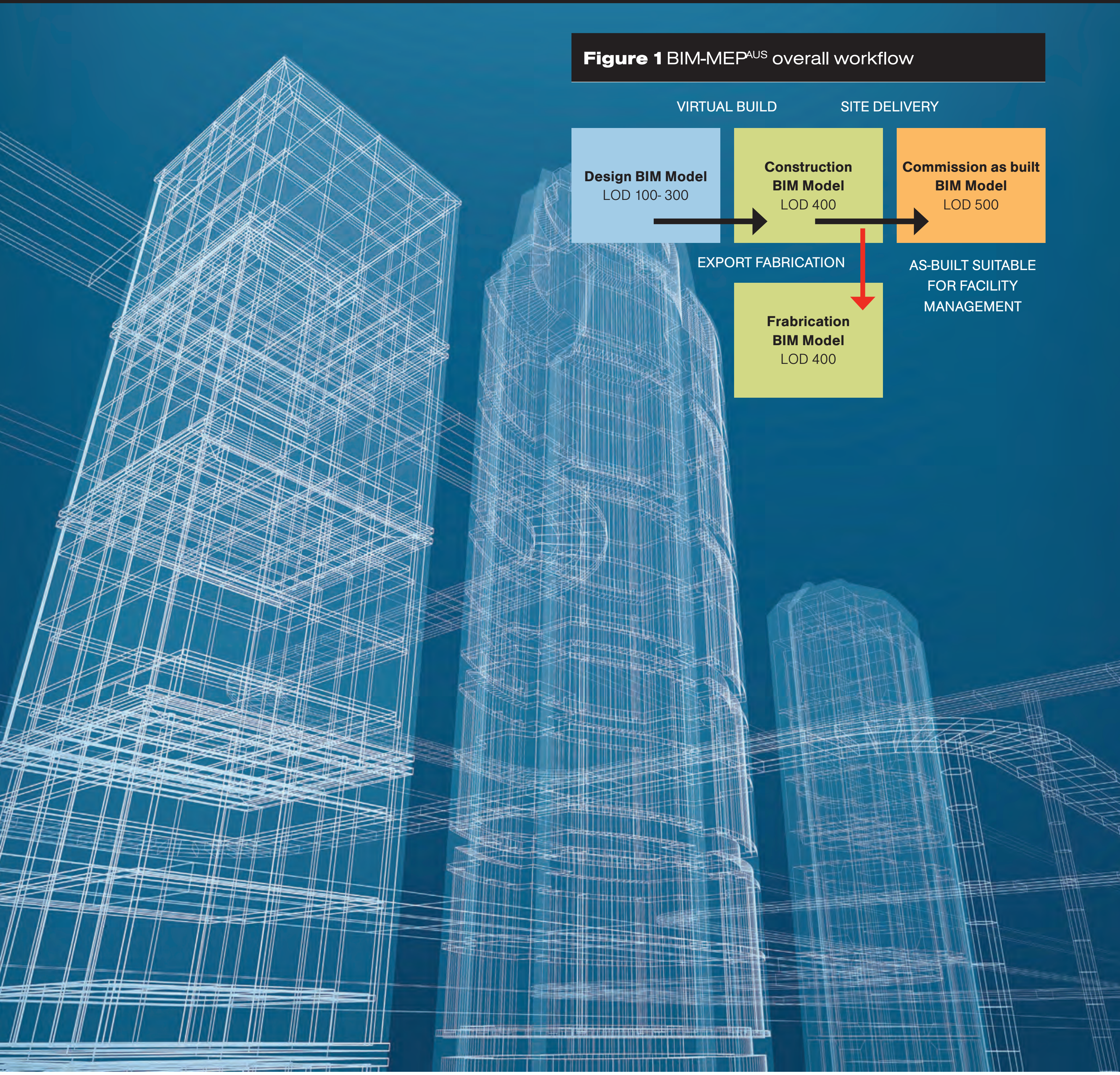
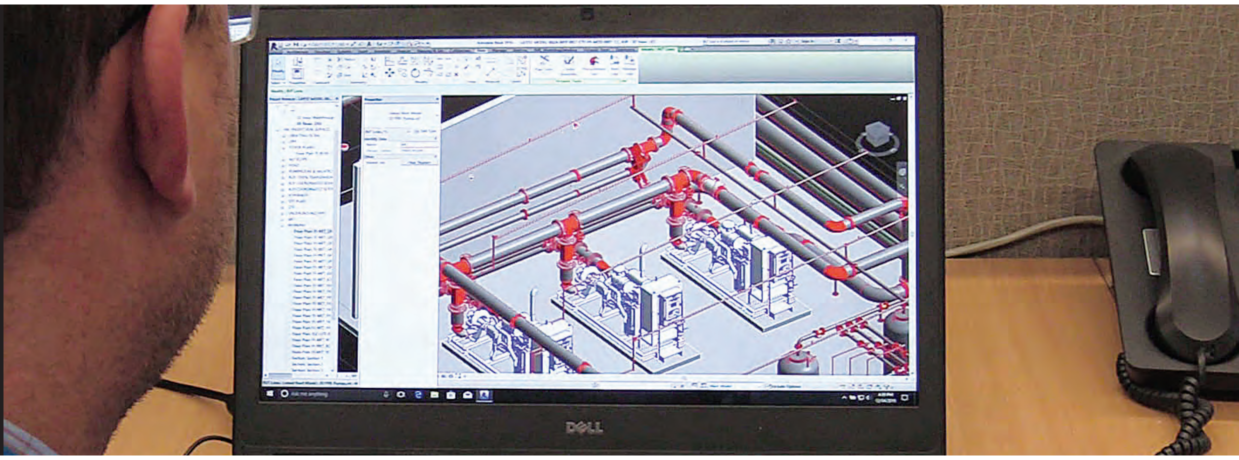
BIM ME UP, SCOTTY!

Building information modelling has an important role to play in the future of fire protection.

Figure 1 BIM-MEP^{AUS} overall workflow





BIM is already in use by many parts of the construction industry.

BY **GEOFF FLOWER**

AG Coombs Advisory/Walker Fire Protection

Building information modelling, or BIM, is increasingly being used for design of buildings, particularly by architects, structural engineers and mechanical engineers. BIM has many potential advantages, and these disciplines have been early adopters—leaving the fire protection industry behind to play catch-up. While many projects that have adopted BIM include fire protection, mostly it is just to fit in with the rest of the building design and we are not getting the real advantages.

So what is BIM—and how is it different from traditional CAD? Both are forms of computer-aided design, but while CAD is essentially a tool based on manual drawing, BIM is a process based on data and transfer of that data. This data forms the 'information' part of BIM.

Put simply, a CAD drawing comprises lines and symbols arranged to represent a system, while BIM is a model of a system represented by lines and symbols.

The difference is that unlike CAD, the model knows that components of a system are connected to each other. For instance, a BIM model of a fire sprinkler system may comprise several sprinkler heads connected to pipework, which is connected to a sprinkler control valve assembly that is supplied from a static water storage tank via a fire pump-set. Each of the components knows it is connected, and there is the opportunity to include data within each component of the model.

The types of data or information that can be included in a BIM model are as follows:

- geospatial (3D): information about dimensional and relative location of the component
- time (4D): time attributes such as delivery lead times, installation times
- cost (5D): cost data of the component
- design parameters: information relating to the basis of design, e.g. occupancy or hazard classification
- detailed material and equipment attributes: e.g. cable cross-section area, pump duty point
- commissioning results: data obtained during commissioning, e.g. sound levels obtained during emergency warning and intercommunication system commissioning.

Much of the focus on BIM to date has been around the geospatial information or 3D building design to avoid clashes between large building elements during construction. This avoids rework and significantly reduces costs. Other potential benefits include:

- undertaking calculations based upon the model (don't need to model twice)
- computer-aided manufacture—export model directly to fabricators
- computer-aided installation—providing significant safety benefits.

BIM promises significant benefits. However, several challenges still need to be addressed. One of the key challenges is training, since the tools and approach used to create BIM models are significantly different from traditional CAD. Much of the recent focus on training in the fire industry has been on site installation and maintenance personnel, but the adoption of BIM will require a significant investment in training of design and drafting personnel.

Putting the issue of training aside, the bigger challenge is barriers that prevent the flow of information between building designers. This is due to issues such as:

- use of different software tools
- development of proprietary elements
- incompatible workflows
- different terminology.

One advantage of being a late adopter is that the fire protection industry can take advantage of the work undertaken by the early adopters so that we can reap the benefits more quickly.

Of particular relevance is an initiative of the Air Conditioning and Mechanical Contractors' Association, known as 'BIM-MEP^{AUS}'. While initially focused on air-conditioning systems, it has been developed with broader building services in mind. MEP is the term used in the US for 'mechanical electrical plumbing', which in Australia and the UK is generally referred to as building services.

In the early days of BIM adoption in Australian building projects, each party in the design and installation team developed their own proprietary content. This significantly disrupted the flow of information between project stakeholders and eroded the benefits of BIM adoption. To put this in perspective, a 2004 National Institute of Standards and Technology report[1] estimated that the cost of inadequate interoperability in the US capital facilities industry was at least US$15.8 billion.

In 2010, the BIM-MEP^{AUS} initiative was formed with two initial objectives: achieving seamless interoperability of building model information from the design team to the construction team, and integration with the supply chain, such as fabricators and product manufacturers. BIM-MEP^{AUS} publishes standards and templates comprising workflows, guideline documents, specifications and models. When adopted by all project stakeholders, these resources mean that the process is clearly defined, and that each party understands the information they are expected to both provide and receive.

This means that the model developed by the design team is passed directly to the construction team, which can issue it to fabricators and update the design to 'as-built'. The commissioning team adds commissioning data to the model before handing it over to the building owner, who can then use the building model for ongoing maintenance of the building (Figure 1).

The BIM-MEP^{AUS} standards for

heating, ventilation and air conditioning and for mechanical services are now well established, but the equivalent standards for fire protection are not. The good news is that the overall system and workflow are established, and all that is required is some effort to use the mechanical templates as a basis for preparation of specific standards that suit fire protection systems. So what is required?

The model has four main components:

- BIM-MEP^{AUS} naming convention
- BIM-MEP^{AUS} Revit template add-in
- BIM-MEP^{AUS} specifications
- BIM-MEP^{AUS} shared parameters.

Of these, the naming convention is most fundamental. While it is not common within the fire protection industry to use naming conventions, mechanical and electrical services often use naming conventions for plant and equipment. For example, a series of stair pressurisation fans may be SPF-1, SPF-2, or an electrical distribution board may be DB-1.1, DB-1.2. Part of the reason we don't often use similar naming conventions in fire protection is typically because there is not much plant and equipment to keep track of—a couple of fire pumps, a fire panel and some sprinkler control valves, for example. To take advantage of the benefits promised by adopting BIM as standard, however, a well-defined naming convention is essential.

While it sounds like a simple exercise to prepare a basic nomenclature, several issues will crop up. It should also be stated from the outset that there will always be situations where a standard nomenclature will not adequately cover a particular need. However, the key is to develop a naming convention that will suit the vast majority of applications.

The BIM-MEP^{AUS} naming convention is based upon a hierarchy that starts with definition of a system, which is then made up of plant, equipment, fittings and interconnected services. Fire protection has several systems, including those in Table 1.

One of the first challenges in defining the nomenclature is to decide if the special hazards systems need to be defined separately, or should be simply categorised as one fire-suppression system. Furthermore, most special hazards systems incorporate a fire detection and alarm system, so it would need to be considered how this fits in. Another similar issue is that of combined suppression systems, such as a combined sprinkler and hydrant system, which use common infrastructure.

Then we need to consider plant. In the context of BIM-MEP^{AUS} standards, plant refers to major components of a system that are typically associated as part of the system infrastructure. For fire protection, this may be pumps, static water storage tanks, fire detection control and indicating equipment, and gaseous suppression-agent storage containers. Issues that will need discussion and resolution in relation to plant include the following:

- is an ancillary pump (e.g. jacking pump) considered different from a fire protection pump?
- are fire pump controllers and fuel tanks separate plant?
- do we used long-established abbreviations, such as FIP for fire indicator panel and EWIS for emergency warning and intercommunication system, or do we adopt the current standard abbreviations of FDCIE (fire detection control and indicating equipment), EWCIE (emergency warning control and indication equipment) and EICIE (for emergency intercommunication control and indication equipment)?
- is a fire fan control panel a separate plant to the FIP/FDCIE?
- are sprinkler control valves plant or equipment?
- is a gaseous-suppression local control station considered as plant (part of the control and indicating equipment)?

Equipment includes valves, pressure/flow switches, booster assemblies, fire hydrants, fire hose reels, fire detectors, emergency warning speakers and fire extinguishers. Fittings would include elements such as sprinkler heads and cable junction boxes. However, there are several potential grey areas as to whether an element is classified as equipment or a fitting; for instance, in the previous description, fire detectors have been identified as equipment while sprinkler heads are classified as fittings.

While the classification of equipment and fittings will need further debate, one of the guiding principles is the type of information that needs to be associated with the component and the need to schedule the components. Equipment will typically be scheduled with information about commissioning or other attributes, whereas fittings typically would not be scheduled. For example, a schedule of fire extinguishers with the type, capacity and rating of each extinguisher is important baseline data, whereas a schedule of every sprinkler head is not normally of much benefit.

Fire Protection Association Australia has recently signed a memorandum of understanding with BIM-MEP^{AUS} to support the initiative. It is intended that BIM-MEP^{AUS} will host several fire protection industry forums in which FPA Australia members will be invited to participate. This is our call to action and chance to have our say in the founding documentation for the Australian industry standard for BIM as applied to fire protection. Look out for the announcements, as this is an opportunity not to be missed. ■

1. https://nvlpubs.nist.gov/nistpubs/gcr/2004/NIST.GCR.04-867.pdf

Table 1 Fire protection systems

Fire-suppression systems	Sprinkler (including wet, dry, pre-action and deluge) Fire hydrant Fire hose reel Portable fire extinguishers
Fire detection and alarm systems	Fire detection Emergency warning system Emergency intercom system Fire alarm monitoring system
Special hazards suppression systems	Gaseous suppression Water mist Foam suppression Wet chemical kitchen suppression Condensed aerosol fire suppression

Geoff Flower spoke about BIM at the recent Fire Australia Conference & Tradeshow 2018.