



# THE BAY DIMENSION

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**In this Edition:**

Fly Me to the Moon .....	1
Cost Estimating & Cost Management.....	2
Escalation Trends .....	3
Embassies .....	4

## Fly Me to the Moon

Geoff Canham

It may be a while before you can book a trip to the moon, but space tourism is about to take off, or should we say 'lift off'. Currently space tourism can take the form of a near space experience in a two-seater MiG fighter jet (flying to an altitude of about 13 miles), a zero-G experience in the so-called "vomit-comet" (as Stephen Hawking did recently), or if you have made your fortune creating something successful like Microsoft Word you might be able to afford a seat on a Salyut spacecraft and enjoy a few weeks at the International Space Station as Charles Simonyi did (the 10-day trip costing over \$20 million).

However, in only a few years Virgin Galactic will be operating suborbital flights that will be expensive, but not out of reach for a lot of people. Current plans are to start operations in 2009, with the fare being \$200,000 initially, and it is expected that that price will attract a lot of potential astronauts who would love to get even a quick view of earth's globe from space. Orbital flights will not be far behind. Robert Bigelow has already test-flown a prototype of the orbital hotel he is planning, and a number of companies are working on orbital craft that can rendezvous with such a facility. For instance, PlanetSpace in Ontario, Canada, are developing the suborbital Canadian Arrow craft, to be followed by the orbital craft known as Silver Dart.

Private enterprises are not just interested in the headline setting manned spacecraft market. The market for unmanned orbital satellites has existed for some time, with Sea Launch being the first in the market (the writer was involved in the Sea Launch Home Base facility at Long Beach, California). Others are now beginning to compete in this lucrative market, such as The Space Exploration Technologies Corporation (SpaceX) with their Falcon 1 rocket.

Richard Branson's plans for Virgin Galactic flights include three days of training for the tourist astronauts before a flight, and others working on space tourism advocate similar



sessions, so these developments will require new or upgraded launch and training facilities. These Spaceports are likely to be a cross between an airport and a theme park, with hotels, flight-simulators and other rides and training facilities, along with the actual launch (and landing) area. Noise abatement will be a more serious problem than with current airports, although if plans for hypersonic aircraft (which almost count as spacecraft) do become a reality, then airports will have more problems with noise abatement too.

Apart from Sea Launch, the US's first commercial spaceport is being developed (for a price tag of around \$200 million) in the desert of New Mexico, where SpaceShipOne made its successful X-Prize flights a couple of years ago, but we can expect to see other spaceports being developed across the nation, and around the world (such as the planned Spaceport Singapore and Spaceport Sweden) as tourists start to reach for the stars.

[Geoff is our in-house LUNARtic – a member of LUNAR, the Livermore Unit of the National Association of Rocketry]

## Cost Estimating & Cost Management

Niall Durkin

At all phases of the facility planning and procurement process, organizations require the prediction of costs they plan to expend. Common uses of cost estimates include:

- Preparing feasibility studies and project budgets
- Predicting the probable bid amount during design
- Providing cost comparisons between alternate design solutions
- Providing estimates of project cost changes during construction

The following is a brief overview of the typical methodology and deliverables for cost estimating:

**Concept / Feasibility Stage:** A cost model is produced by developing the clients program into concept stage estimate line items. As various options are studied and changes are made the impact to the overall project costs can be included in the analysis. Cost models can be produced

using parametric unit costs (\$ / Gross Floor Area) or functional units (Cost per parking stall, hospital bed, hotel room etc).

**Schematic Design:** As the design is developed in more detail, quantities will be generated from drawings and other Schematic Design documents and used as the basis of a schematic level cost estimate. As the various design options are evaluated and studied the cost estimate will be adjusted to reflect changes under review. Independent of the design documents it is also possible to study a broader range of design options, some of which will be based on the key criteria quantities derived from the cost estimate. Examples of typical Schematic Design stage cost studies include steel v concrete frame, central plant v stand alone heating / cooling systems, above grade or below grade parking.

**Design Development:** As the design becomes more detailed the corresponding cost estimate will reflect this level of detail. In addition to studying various design options the estimate can also be used as a method of analyzing and selecting finishes and other building components that will not be identified on the drawings. It also serves as a primary tool in Value Engineering



**Construction Documents:** Cost estimates can be produced at various stages of completion during the Construction Documents Design Stage, (usually 50%, 90% and 100%). These estimates are usually more for controlling the budget and ensuring that earlier design decisions have been implemented into the documents. Making major changes to the design during the Construction Documents phase will cost the project time and money. Items that had previously been identified as allowances will be developed into detailed cost estimates.

At this stage in the estimating process it will also be possible to produce detailed descriptions and quantities for various work packages. This can be of use during the bidding

process. Having a detailed scope of work and involving the cost estimator in the bid interview process should help to ensure that each subcontractor is pricing the same scope of work. This reduces the time required to “line up” subcontractors bids and ensures that the subcontractor with the most economically advantageous bid is selected for the project.

**Contract Administration:** During the construction stage of the project, subcontractor change orders can be evaluated by reviewing and pricing quantities from the updated design documents. Negative change orders based on drawing revisions can also be identified and negotiated with subcontractors.

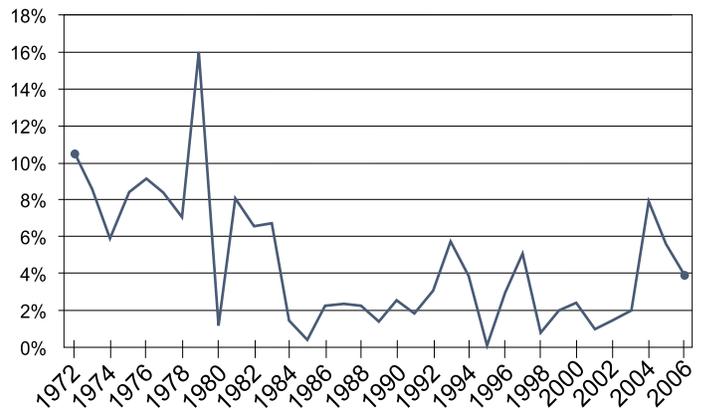
Client requested changes during construction can be estimated based on outline information to enable the client to make educated decisions on the value of such changes without wasting time and money adjusting the construction documents.

Cash expenditure for construction can be anticipated and tracked based on the contractors schedule and subcontractor bids, enabling efficient use of client funds.

how escalation rates had changed. Unfortunately our own index only goes back to the start of 2003, so we looked elsewhere for the comparisons, specifically to the ENR’s Building Cost Index and to Saylor’s Subcontractor Index. The former is national in its context and looks at changes in a specific basket of materials and union labor rates. The latter index is California based and looks at particular subcontractor prices, so it is more a gauge of bid prices.

The following chart shows the movement of the ENR Building Cost Index over the past 35 years:

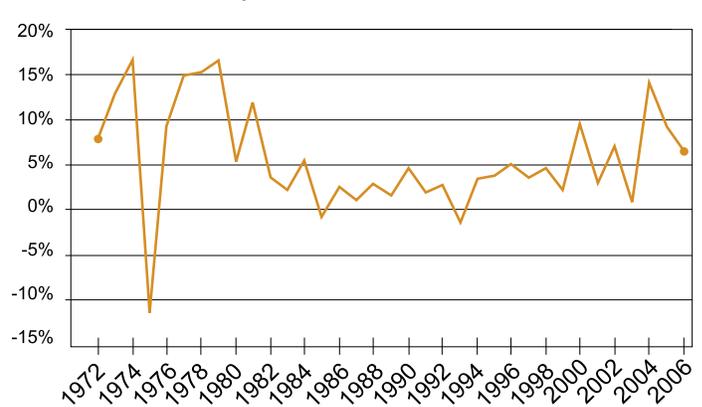
ENR BCI



That chart shows some fairly high annual price increases over the first decade that we are looking at, then approximately 20 years that vary up and down around the 2% mark, then the rate jumps up again in 2004.

The Saylor Subcontractor Index shows similar trending, but since it reflects market conditions to a greater extent, the swings are wider:

Saylor Subcontractor Index



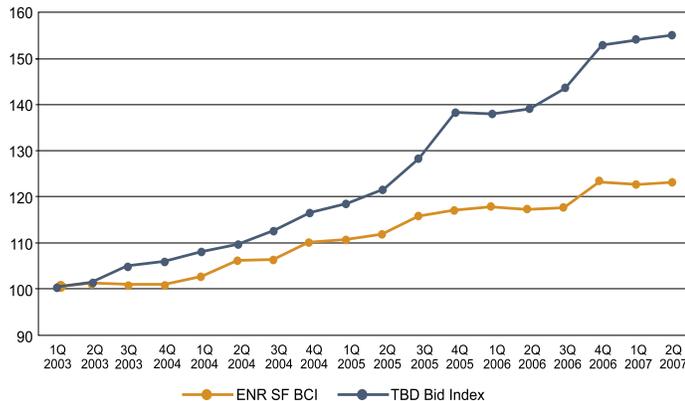
Averaging the annual increases over these three time periods shows the following:

## Escalation Trends

The latest update of our TBD Bid Index (for the second quarter of 2007) still shows bid prices rising, but not as steeply as during the past couple of years.

Does this mean that we have reached a peak in the recent price increases? It may be rather premature to suggest that. History doesn’t always repeat itself, but it doesn’t hurt to consult it, so we looked back over the past 35 years at

Bid Index



Year Range	ENR BCI	Saylor
1972-1981	8.32%	9.88%
1982-2002	2.62%	3.15%
2004-2006	5.78%	9.92%

The fact that we are starting to see similar annual escalation rates to those occurring 35 years ago doesn't mean that we will be in for a similar decade long period of high escalation. But there does seem to be a lot of construction work being planned for, and if contractors have full books, they have no incentive to lower prices.

## Embassies

An ambassador is a representative of a state, and an embassy is the same in many ways. Also like a state, an embassy needs to protect its borders. At first glance an embassy could be considered similar to a prestige or headquarters office building, but in addition to providing office space for the ambassadors and staff, an embassy requires public areas for visitors who require information or assistance, accommodation for ceremonial functions and private secure areas for political operations. Thus, there are contradictory needs for the building to be open and inviting to the public, yet secure and secretive for diplomatic purposes. Design can be more complex when the embassy compound includes the ambassador's residence and staff housing; this is not typical.

Normally, an embassy would be a one-off/stand-alone facility located in the capital city, but it might be an existing office building that has been renovated, or even leased space in an office building.

Security covers a number of issues, including:

- Terrorist attack: Blast/bomb-resistant building design is a factor on siting and landscaping of the complex, size of structural elements, exterior walls and windows and even interior finishing. Probably the majority of recent work on embassies in recent years has been retrofit work related to blast protection and progressive collapse.
- Anti-espionage: The anti-espionage elements of embassy design go beyond surveillance and detection. The communications center may be a concrete vault with dedicated mechanical and electrical systems. Special measures would be taken to seal any openings for service entry.

- Intruder prevention/determent/detection: Intruder prevention/detection systems for embassies should be as "state of the art" as possible. They are often installed late in the project schedule. Sometimes security systems may be excluded from the construction contract and installed following completion.



The embassy is a visual and public representation of the home government in the host country, and this is often reflected in the design through a combination of the styles and materials in both the home country and the host country.

By their nature, there is not a large market for new embassy building design. They often involve architectural competitions which awards the design commission to a respected design firm. Such projects tend to move slowly because they are subject to exhaustive reviews and interaction with key embassy and ministry staff, and other interested bodies from both states.

There are many factors that drive the cost of embassy construction costs far higher than regular prestige office construction, including:

- The design of the structure and enclosure to mitigate effects of terrorist attacks.
- Security installations, including such items as surveillance systems, access control, and the design of the site and surrounds to keep potential terrorists' vehicles away from the building.
- Requirements for a secure communications center, and measures to ensure that data is not being accessed by outsiders.
- The use of materials and labor transported from the home country.
- Standby systems for electricity, water, telecommunications and other systems.
- High standard of finishes, especially in public and ceremonial areas.