

Yet Another Benchmark - Part III

Le Polynésien (1918)

Line Marking Systems In Use Around The World - Part I

Adaptive Algorithms

Diving Pioneers & Innovators: A Series of In Depth Interviews (Greg MacGillivray)

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Editorial

Welcome to the 14th issue of Tech Diving Mag. A series of articles comes to an end (Yet Another Benchmark), and another one starts (Line Marking Systems In Use Around The World).

One piece of info I'd like to share with you; a new book on decompression titled *Deep Into Deco* should be on the shelves in a couple of months. Keep your fingers crossed.

The contributors for this issue are world renowned industry professional Bret Gilliam, technical diving instructor Albrecht Salm (PhD), decompression scientist and cave diver Peter Buzzacott, cave explorer and book author Duncan Price and technical diving instructor and master mariner Fritz Farrugia. Get to know more about them and read their bio at www.techdivingmag.com/contributors.html.

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Asser Salama
Editor, Tech Diving Mag

A full-page underwater photograph serves as the background. It depicts a diver in silhouette at the bottom center, looking upwards. Above the diver is a massive, dense school of fish, possibly sardines or anchovies, filling the upper two-thirds of the frame. Sunlight filters down from the top, creating a bright, hazy glow and illuminating the fish. The water is a deep, clear blue.

Yet Another Benchmark - Part III

By Albrecht Salm

This is short dive into the world of statistical modeling of dive tables. But before we submerge with pure numbers, read the short motivation from the Intro. This may tell you that concerning decompression sickness you should not rely on your intuition but look only for the real data, i.e. the outcomes of the dives (i.e.: YOUR dives!).

Intro

To put it bluntly, the occurrence of decompression sickness (DCS) in man (or girls) is:

- a random event
- not reproducible
- violating a deco table or a no-decompression limit (NDL) does not guarantee DCS (Source: [1])

And: more the worse, even the pure contrary of the last statement is valid! Let's take a look at the ca. 70 dives with healthy US Navy divers, done in the 50's (Source: [2] & [3]). These have been controlled chamber dives with the divers resting or exercising afterwards. The ascent rate was always uniform and prescribed with the then usual 25 feet/min (7.6 meters/min). There have been no decompression stops made.

Now: 4 men dived to 150 feet (45 meters) for 36 min on air, surfaced with these 25 feet/min (7.6 meters/min) and made no decompression stops.

Q: how many suffered DCS?

Remember the time-to-surface (TTS) of the two military decompression tables:

USN Air Table (2008) calls for ca. 128 min TTS, whereas;

USN Air Table (1957) calls for ca. 60 min TTS.

A: the result is: none! That is: no cases of DCS for these 4 men!

Now another one: more men to a shorter dive to the same depth: 11 men, 150 feet (45 meters) for 30 min on air, surfaced with 25 feet/min (7.6 meters/min) and no decompression stops.

Q: how many suffered DCS?

USN Air Table (2008) called for ca. 59 min TTS, whereas;

USN Air Table (1957) called for ca. 35 min TTS.

A: all! I.e.: 11 cases of DCS (5 cases of mild DCS, 6 cases of bends).

Basics and difficulties

There is a wealth of literature on the statistical formulation of decompression tables. We should not repeat that here, but have a look at the basic sources ([4] and [5]) and the 11-volumes series from NMRI / NEDU: "Statistically Based Decompression Tables: I -> XI" from 1985 – 1999, ca. 1,000 pages with short comments from my side at the end of this paper.

In a nutshell, it works like this: we collect not only hundreds but thousands of (very) well-documented dives. Well documented means here: there is a controlled and reproducible environment (breathing gas composition including humidity and CO₂, water and air temperatures, workload, ascent and descent rates) and as well the controlled biometrics of the divers. Then we group them together per procedures: say, saturation dives in one group, EAN dives another, Heliox or constant pO₂ the next ones, repetitive or multi-level in others and so on. As well the inert gas dose (time, depth combinations) should be comparable. The rationale for this is that it is very probable that no "unified deco theory" would allow for an explanation of all these phenomena.

The next step is to collect the outcomes of these dives. Either in scales of Doppler bubble grades (I to IV or so) or in a more digital black-and-white manner: DCS YES / NO.

Here starts, btw, one of the first difficulties of assessing DCS: how about vanishing niggles, a little skin rash or a short period of migraine? Does it count, or not at all? Do we attribute 10, 25 or 50% of a DCS case? Well: this is called the “pink noise” within the measurement.

And, there is another difficulty: in the past, much effort has been done to assess the relationship between age, gender, BMI (body-mass-index) and DCS or Doppler-bubbles. The relationship was found to be positive. The underlying statistical problem, which rendered the masses of papers more or less useless, was the so-called “multi co-linearity”, which was not corrected in these publications. I.e. the real underlying parameter for the Doppler-bubbles was (probably) the aerobic capacity, which is the “fitness”. Multi co-linearity describes the fact that a couple of parameters, like increasing age and increasing BMI go in the same direction as decreasing fitness. So the data was biased. And so were the conclusions drawn.

As was the case with the PFO, the patent foramen ovale, a little hole between the atria, the antechambers of the human heart, which approx. 30 % of the population has. There was a famous study, technically brilliantly designed to check for brain lesions (that is, little defects in your brain) with ca. 215 divers. The sensational result was, that if you do a lot of repetitive (more than 100 a year), Tec-like dives (deeper than 40 meters, decompression, cold fresh water lake) you are really prone to DCS-related brain impairment. But there has been no check for a PFO in these divers; to put it mildly, this little procedural error left the whole study open for controversy.

The point here to make is: if the biometrics of the guinea pigs (our divers) are not carefully screened, it may render a whole research-study useless.

After the assessment you have a numerical scale. Now you have to fit that to your gas kinetics model. Be it a dissolved gas-phase, a bubble-volume model or whatever combination thereof. The measurement of the goodness of a “fit” is usually done with the logarithmic scale of likelihood. The result is either a “label” for your dives, being, for example in the 1, 2 or 5% probability of DCS, the P(DCS). P(DCS) is the probability P of contracting a decompression sickness DCS. It follows usually a so-called dose-response curve, what is already well-known from drugs, O2 and antibiotics. In our case the dose is either depth d, time t, a combination thereof like d * square root (t) or another measure for a compartment saturation / supersaturation. The formula for this “Hill Dose Equation” looks like that:

$$P(\text{DCS}) = \text{Dose}^a / (\text{Dose}^a + b)$$

Or you tabulate like a standard decompression table, giving it the sobriquet of the predicted P(DCS) outcomes. So it may look like that:

Depth	USN 1957	USN VVAL18	Standard Air Model [min]		
[fswg]	[min]	[min]			
			2% P(DCS)	1% P(DCS)	3% P(DCS)
80	40	40	37	24	45
90	30	34	31	20	38
100	25	29	26	17	32
110	20	26	23	15	28

No-Stop Bottom-Time Limits from 3 Sources; Table 3, p.28; Excerpt taken from: A SIMPLE PROBABILISTIC MODEL FOR ESTIMATING THE RISK OF STANDARD AIR DIVES. Van Liew, Flynn: TA 01-07 NEDU TR 04-41[6].

Let's have a look at the 100 feet entry: the old USN table gave 25 min as a No-Stop limit, putting it near a P(DCS) of 2 % with 26 min. This is quite a lot: it would imply that approx. out of 50 such dives we would have one guy (or girl) ending up in the deco-chamber. The 1 % P(DCS) would yield a reduced No-Stop time of 17 min.

And, there is another problem, intrinsic to the very nature of DCS: it is the fact of small numbers. In the average, we have one case of DCS per 10,000 recreational dives. This is not much, and it is quite OK. Or as our friend Paul K. W. put it: "If you want to do research on DCS: you have to have it!"

For example, there have been publications in the past, telling that the use of dive computers is much safer than the use of the traditional dive tables. The story here is that we do not know how closely the dive computer users followed the profiles from the table users...

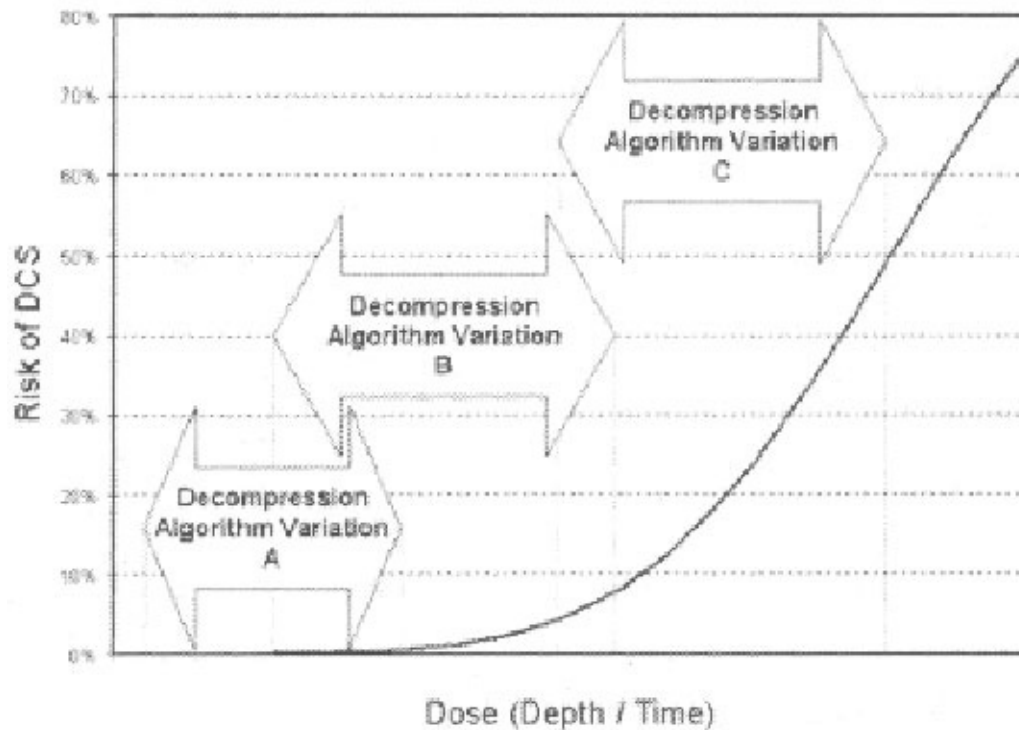
And this is the next problem: if your dive was safe, you do not know how closely you have been to DCS. To put it the other way around: a useful contribution to DCS research is only a validated case of DCS! The real endpoint of DCS is death: a point, clearly not so desired for human experiments. This is the rationale, why millions of small and not-so-small guinea-pigs have been sacrificed on the lord's table of the cruel mistress of science for the welfare of divers.

Concerning P(DCS) we normally speak about the dive profile, fO₂, skin temperature and workload. We did not speak so far about: blood chemistry, the so-called "MPs" (micro particles) and the lining of the blood vessels. But this is where topical DCS-research is aimed at.

Results

So what is it now all about this statistical modeling when we have so many variables to control? Wasn't that ole' Haldane model not much more simple and didn't it work? Well, it did, really. Up to a certain extent. But if the dive was very short or very deep, it didn't! As well Haldane himself was already aware about the limitations and the problems with age and adiposity (old and fat divers). Nowadays we have a lot more models, a couple of them dealing not only with the dissolved gas phase, as Haldane did, but also with the free gas phase, the bubbles. And subsequently started a sometimes heated debate, which of the models is now better. And the down side of this debate is that it leaves the diver completely in the dark: have a look at the tables with the big variations in the TTS for our "test dive" (pls. cf. the "Yet Another Benchmark" Parts I & II in Tech Diving Mag Issue 11, p. 6 & 7; and Issue 12, p. 4 & 5). But the proponents of each of these models forgot a basic wisdom: all of these models are wrong, basically! And there is an elegant way out of this debate: these kinds of traditional models try to predict the outcome of the dive before, based on the model assumptions. This is why these are sometimes called: "deterministic". The statistically based models avoid this and work the other way around: in hindsight the outcomes of the dives are analyzed. And based on this analysis there is an interpolation or extrapolation for similar dives.

A generic plot of a P(DCS) resp. the risk versus a dose looks like that (Source: [8], p. 89):



A P(DCS) of 0 means you have none whereas a P(DCS) of 1 means you ended up in the deco chamber. But in between is a big gray area of individual and intra-individual susceptibility, where this is not so clear and humans or guinea pigs do not react in a proper digital Yes/No manner on a varying inert gas dose. So, next question.

Q: when you have been bent like a pretzel on your last dive, is it more probable than not, that you may get bent for another time?

A: statistically speaking: yes! Why so? Not speaking about the personal susceptibility for DCS which really plays a dominant role in all these statistics. If you look at the collections of many dive

outcomes, preferably with the same subjects (for e.g. from the big offshore diving companies or the organizations for public health), you will see that there are DCS-candidates, divers which will contract DCS more easily than others.

But statistically speaking the story is the following: tossing a coin and betting for head or tail is like getting DCS, a binominal distribution. And it is more likely than not, getting a run of 3 tails (or 3 heads) in a sequence. Here the probability in 10 tosses is $864/1,024$, i.e. ca. 82% [7]. So this is more likely than getting a head after a tale, or vice-versa!

Lessons learned for TEC diving

Lesson #1: donate your dive computer log files to DAN's PDE.

In the first place, the biggest part of dives, being Tec or recreational or whatever, does not match the required basic quality criteria described above: they cannot be used for a proper statistical analysis. This yields even as well for the big DAN PDE database: neither the skin temperature nor the workload, nor complete biometrics are available. As well the DCS assessment is questionable. Normally, if there are Doppler readings these are not taken double-blinded. But, as we pointed out here in "Yet Another Benchmark, Part II" in Tech Diving Mag, Issue 12, p.9.:

- It is a good starting point!
- And you have to start somewhere!!
- And you should contribute your log files to DAN's data base!!!

In any case this is by much better than another data base, very often cited within papers, gloating about a DCS rate of 19 from 2,823 deep and multi-gas TEC-dives and thus trying to insinuate the safety of a certain undocumented decompression algorithm. There are no logfiles for public scrutiny and the input was obviously partly from

“wrist slates of seasoned divers”. This is just scientific garbage! So DAN’s idea to collecting the very details of the profiles via the DLT #7 file format directly converted from the dive computer logfiles is the only way out to get a broad data base where a ballpark of the inert gas dose could be re-evaluated even years later.

Lesson #2: question your extrapolations.

(pls. cf. as well: Tech Diving Mag Issue 5, p. 41 - 53). What a normal desktop deco software or an implementation into a mixed gas dive computer does outside the safe and proven envelope is standing on statistically relatively thin and fragile leggies: but this is just, how the algorithm works with larger values! Resilient data from longer and deeper mix gas dives with a lot of O2-deco is still missing. And resilient means: not just anecdotal experience from one TEC dive which was successful. But you probably want to know, where along the P(DCS) curve your deco-software or your dive computer puts you! [8]

Lesson #3: monitor your dives / your DCS outcomes.

That is: do Doppler measurements after all your dives, record the profiles along with your settings (e.g. gradient factors and the like) with your measurements and your self-assessment.

Lesson #4: caveat boundaries!

There is no way of extracting a useful deco procedure from a pool of data, when yours does not match the decompression procedure or the inert gas dose! Do not even try! Or you have to accept, that doing dives like the record dives Mark Ellyatt once did [9], will put your P(DCS) in close proximity to 1.

Lesson #5: mistrust small numbers!

That is, do not believe in publications, relying on small numbers of

divers / dives. A couple of years ago there have been rumors concerning cancer-markers (biochemical traces in the blood, resulting from growing of ill-behaving cells) found after EAN-dives. Here we had the usual problem, that this study covered only a handful of divers, doing just a couple of dives: the error margins have been exceeding the original values.

Lesson #6: (the bitter pill for people like us).

We should not sell NDLs. At least not in the careless way it is done by a couple of diver training agencies and dive computer manufacturers.

Finale furioso

If the intro did not beam you away, well, then, here is the last, a personal one: during our Guinness world record of underwater indoor cycling (yep, we did that, 12 years ago) we made 9 dives on air to 8.5 meters (ca. 27 feet in warm fresh water) in our diving tower. We stayed in teams of 3 divers there for exactly 60 min cycling on an underwater-ergometer (well, not so much, but ...), surfaced slowly, stayed approx. 3 to 5 min at 3 to 2 meters (10 to 6.6 feet) as a safety stop and had a surface interval of precisely 3 hours. So in the end this was a “near / sub-saturation” dive for 36 hours. In the background at the upper part of the little picture, near my air-bubbles, you could see our “deco-rig” hanging around in our diving-tower:



OK: no deco table and no deco-software from this mean ole' world did call for these deco stops, not even the DCIEM table with all security features enabled. In the end, that is, around dive #6 and 7, nearly the complete team had various problems. And two divers had niggles and one a serious DCS Type I (me! (Being that time already the old grand-pa of the complete team). I took some normobaric O₂ (and a couple of Aspirins®). And then I did something stupid but responded very well to re-compression: I did the dives #7, 8 & 9 with EAN36 and extending the deco stops to 10, then 15 and finally to 20 min with EAN60!).

* * *

So, this is the very end of the series “Yet Another Benchmark” of 3 somewhat lengthy and “dry” articles. If you want to go through the mathematical details of the screen shots in “Yet Another Benchmark, Part II” in Tech Diving Mag, Issue 12, p. 7; pls. cf. as well there the detailed references to these sources. Here we are:

Method I; Southerland, p. 77, 78, 82; with:

Logit (DCS) = $\ln(P/(1-P))$.

Logit (DCS) = $-25.95 + 6.64 * \ln(\text{Depth}) + \beta_2 * (\ln(\text{Depth}))^2 + 5.31 * \ln(\text{Time}) - 0.33 * (\ln(\text{Time}))^2 + \beta_5 * \ln(\text{Depth}) * \ln(\text{Time})$

with: $\beta_2 = \beta_5 = 0$

Method II:

is an expanded PME Model. PME means: “Parallel Mono-Exponential” and has been developed during the middle 80’s based on ca. 1,700 air dives. The thus calibrated parameters have been compared to 10,391 well-documented dives in the volume I of the NMRI/NEDU series “Statistically Based Decompression Tables”, p. 5-7 & p. 31. We have taken this thing and expanded it even further to 6 compartments and fitted the parameters to our helium dives.

Method III:

is a simplified integral over a risk function which we took from the volume VI, “Statistically Based Decompression Tables”, p. 5 & p. 55. For the fun of it, DIVE calculates the upper & lower error boundary from the given standard deviations.

Method IV; NEDU TA 01-07 TR 04-41, p.8 & p. 11:

$$\text{Logit(DCS)} = a + b * (D - c) * (1 - \exp(-d * T)) / (TDT - g)$$

with:

$$a = -6.022169$$

$$b = 86.596315$$

$$c = 25.091718$$

$$d = 0.002929$$

$$f = 0.918547$$

$$g = -170.304442$$

D: Depth (fsw)

TDT: Total Decompression Time (min)

Method V; NEDU TR 2009-03, p. 9, 11:

$$\text{Logit(DCS)} = \beta_0 + \beta_1 * \ln(\text{fsw}) + \beta_2 * \ln(\text{Time}) + \beta_3 * (\ln(\text{Time}))^2 + \beta_4 * \ln(\text{Ascent Rate})$$

with:

$$\beta_0 = -53.0$$

$$\beta_1 = 7.97$$

$$\beta_2 = 3.32$$

$$\beta_3 = 0.04$$

$$\beta_4 = -0.03$$

Literature cited

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For further reading

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- „Logistic Regression and Decompression Sickness“, David Graham Southerland, Duke University, 1992
- „Statistical Bubble Dynamics Algorithms for Assessment of Altitude Decompression Sickness Incidence“, Gerth, W. A. & Vann, R.D., July 1995, Duke University Medical Center

Statistically Based Decompression Tables, an 11-volume series of papers from the NMRI

Naval Medical Research Institute, Bethesda, Maryland:

NMRI 85-16, Part I: Analysis of Air Dives: 1950 - 1970

NMRI 85-17, Part II: Equal Risk Air Diving Decompression Schedules

NMRI 86-50, Part III: Comparative Risk using U.S. Navy, British, and Canadian Standard Air Schedules

NMRI 86-51, Part IV: Extension to Air and N₂-O₂ Saturation Diving

NMRI 89-34, Part V: Haldane-Vann Models for Air Diving

NMRI 91-84, Part VI: Repeat Dives on Oxygen/Nitrogen Mixes

NMRI 92-85, Part VII: Selection and Treatment of Primary Air and N₂O₂ Data

NMRI 92-73, Part VIII: Linear-Exponential Kinetics

NMRI 96-05, Part IX: Probabilistic Models of the role of Oxygen in Human Decompression Sickness

NMRI 96-06, Part X: Real-Time Decompression Algorithm using a probabilistic Model

NMRC 99-01, Part XI: Manned Validation of the LE Probabilistic Model for Air and Nitrogen-Oxygen Diving

Private comments on the above listed sources I --> XI

Part I:

Table 9 (p. 37) features DCS incidences during operational use of

the USN 1957 Table, depths from 100 to 300 feet, bottom times from 10 to 50 min. From 10.391 dives there are 83 cases of DCS. The reported incidence range within the CI goes from 0.1 up to 4.6 (eg. at 200 feet). The problem with “operational use” is that there is only a written log of the dive. So the time & depth recordings in the logs are somewhat “creative” (i.e. irreproducible).

Part II:

Fig. 5 (p. 14) features a graph of the “Risk Surface” for a certain dive. The trough of the 3-dimensional hyperbola shows the optimum distribution of stop times at various depths, thus minimizing the calculated P(DCS).

Part III:

states on top of p. 1: “... if no cases (of DCS) were seen in a trial with 10 divers, the 95% confidence limits still allows an actual incidence of 31 % DCS. A single case in a 30 man trial could come from 0.1 to 17 % underlying incidence. Hundreds of replicated dives are needed for greater precision.”

Part V:

on p. 3, Table 1, describes their decompression data sets A, B, C, D & L. These are covering 1.835 dives with 101 cases of DCS and a range of 1.3 to 45.7 % DCS.

Part VI:

features a good mathematical overview on the whole subject.

Part VIII:

gives a nice overview on the LE models (linear - exponential), on Table 5 (p. 48) is a summary of the used data sets: 5 risk categories in 2.5 % intervals, for eg. with 2.383 dives and 139 observed cases for DCS for the 0-model. The 0-model comes with a predicted # DCS of 139 cases, but unevenly distributed along these categories. On Table 7 (p. 50) the data sets NOT used for modeling with 1.985 dives and a DCS range from 1.0 --> 21.3 % DCS.

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Use only pure O2 or Nitrox mixes (not Trimix or Heliox)

Minutes of breathing the rich mix on the surface

Minutes of breathing normal air before applying the rich mix

Accelerate

Breathing Mix Calculator

Depth m ppO2 EAD/END m

☒ O2 Narcotic

O2 [%] He [%]

Calculate



Altitude Settings

Dive altitude m

Hours at altitude

☒ Diver acclimatized at altitude

Starting acclimatized altitude m

Travel hours OK

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friendly decompression software on
the market! ==

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Instructor Trainer (TDI, SSI, PADI)

Le Polynésien (1918)

By Fritz Farrugia



The S/S Le Polynisien, built in 1890 and made of steel, was a 152.5m (500ft) French passenger steamer that served on the France-Australia line. Weighing 6,373 gross tons and equipped with a triple expansion engine that generates 7,500 HP and results in a cruising speed of 17.5 knots, she was torpedoed and sunk by German submarine UC-22 when 7 miles off Grand Harbor on August 10th 1918, when en route from Marseille and Bizerta for Salonica. Approximately 20 lives were lost during the sinking.

Lying on her port side at a maximum depth of 64m (210ft), with the starboard side at a depth of 54m (177ft), this wreck is very much intact with various penetration points, providing those with the required experience and training with a very challenging and demanding dive where descending isn't as simple as one may think. She is locally known as the plate ship due to the number of ceramics visible on the wreck itself.

Although not considered particularly deep as a technical dive, the size and integrity of the wreck can be overwhelming. Not to mention the ever prevalent current. Imagine having to pull yourself hand over hand, fighting the current, down the shot line, all 64m (210ft) of it, until you get to the wreck and you start to get an idea of the demands of diving this wreck.

The currents over the wreck, as you approach the dive site, is what occupies every diver's mind, but the reward of getting there, eventually, more than makes up for it, for what you see below you is a vessel, which in spite of her age, is still very intact and thanks to her size allows for numerous dives on it before the need to move on and discover new wrecks.

Positioned several miles off shore, the wreck site can be reached by boat, preferably departing from Marsascala, which is at the south eastern tip of Malta and requires an approximate ETA of 15 minutes. Once on site, the shot line is deployed, together with the decompression stations, which may be disconnected from the shot line, dependant on the current, during the decompression portion of the dive. In my books a certain Trimix dive with various EAN stages to complement the plan, which ultimately allows the diver to conduct a dive in the safest fashion and importantly with a clear head to fully appreciate the wreck and what it has to offer. You could literally spend your bottom time examining 5 square meters (54 square feet), such is the detail.





Once on site, final checks are made and the descent awaits. The shot line may be deployed at 3 main points, the bow, the stern or the vessel's mid section. Exploring the entire wreck in one dive is virtually impossible unless with the use of a DPV, which I won't recommend, simply because every inch of this wreck has something of interest to examine, whether it's the vessel's masts, broken at their stem, the canon at the ship's stern and even a bathroom ceramic lying on deck. One of my favorite routes is descending down the vessel's port quarter and around her stern. Her propeller, undamaged, is impressive in size and design, allowing a diver to easily swim through the individual blades. A quick note here: beside the vessel's own lines and potential snagging hazards, there are various fishing lines and nets, with lines that can be hard to see until it's too late, posing even greater threat. Past the propeller and up her starboard side, a fissure allows for penetration, which acts like a time portal, for once inside, the wreck comes to life, with a bit of imagination of course. Chandeliers, bed posts and all items pertaining to her past come back to life, making your time within the wreck surreal and without a doubt an unforgettable dive, with a lot to talk about and discuss post dive.



Being submerged for close to 100 years, the wreck is covered in corals, sponges and a plethora of marine life, coupled with pelagic fish, making the dive unforgettable, from which, once you surface, your only thoughts are to the next opportunity to dive Le Polynisien.

Best dived during the summer months when currents seem to be at their lowest strength and of course weather conditions usually ideal, turning a mundane day into a dive into the past, where self discipline and respect for the wreck go a long way in ensuring your introduction and relationship with Le Polynisien lasts for a long time.

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Line Marking Systems In Use Around The World - Part I

By Duncan Price and Peter Buzzacott

© Luke Baade

There are many reasons to lay line through a cave and to mark it at certain points. Not only are divers assured of the escape route but delicate and fragile features may be protected, and the location of interesting features highlighted so visitors need not waste time searching for them. Our sport is dynamic and evolves when people discover problems that require innovative solutions. Of course, the typography of cave systems differs between countries, as do our cultures and the availability of materials so it is natural for route marking to have evolved in a number of ways in these differing environments.

This article, the first in a series written by experienced cave divers in separate geographies, summarises the current state of play in two countries on opposite sides of the globe. Of course, there will always be exceptions to the rule and this article is no substitute for local knowledge. Find a local to show you around – that is usually the safest option. But, we hope this article will remind cave divers that there is no one “right” way that suits all caves, and conditions vary around the world.

Dive Safe

Duncan and Peter

United Kingdom (text and photos by Duncan Price)

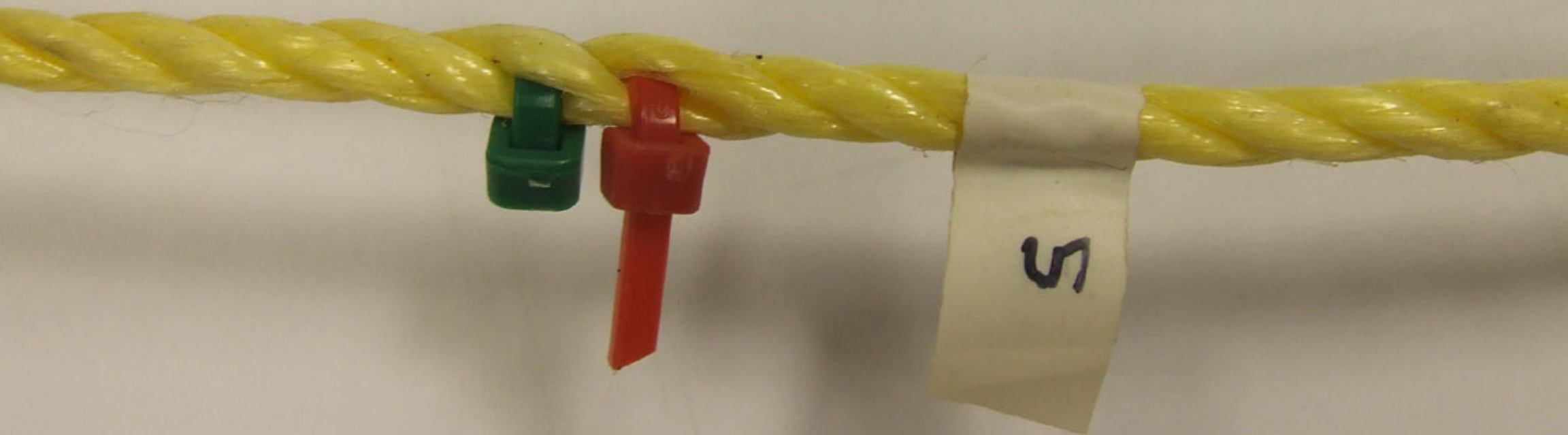
Cave diving in the UK is usually considered a specialist caving activity. The majority of active cave divers belong to the Cave Diving Group which comprises four regional sections representing the major caving regions of Britain: Somerset (Mendip Hills), Derbyshire (Peak District), Northern (Yorkshire Dales) and Welsh (principally the Brecon Beacons and Forest of Dean). There are caves in other parts of the UK including Northern Ireland and Scotland as well as several flooded mine systems. Outside of the CDG there are a growing number

of resident cave divers trained by other agencies such as GUE, PSA etc. who come from a purely diving oriented background and tend to principally cave dive overseas.

The conditions typically found in UK cave sumps of poor visibility, sediments and cold water necessitate thick (3-5 mm) twisted polypropylene line which floats above the floor and is secured at appropriate intervals in the optimum route using a variety of belaying techniques: heavy duty rubber bands made from inner tube (“snoopy loops”) attached to rocks, pipe “silt screws” or sometimes plastic cable ties. Plastic coated wire, climbing rope or even steel chain has been laid as a guideline in some cave passages where a more conventional line is readily abraded.

The standard line marking protocol is to place distance markers on the guideline at 5 (or sometimes 10) metre intervals. Any diver conducting original exploration will employ such tagged line, primarily as an aid to conducting an underwater survey of the cave. Many sumps will have been re-lined since they were originally explored and may not have any distance markers on the line. The quality of directional indicators can therefore vary dramatically between sites and it is essential that any visiting diver researches what to expect. Cave diving in the UK is largely done as a solo activity and although team of divers may be underwater together they tend to act independent of one another and each diver is responsible for their own safety and navigation. The onus is on every diver to carry their own markers such as clothespins (which fit easily on thicker guidelines) or line arrows (which can be difficult to attach/remove). The use of underwater T’s is almost universal and it is rare to have to do jumps. Therefore the running of jump or gap reels is uncommon and good communication is needed if divers are to share this role.

Red and green cable ties (plus distance marker) - the green cable tie is placed on the exit side and the red cable tie is left with a longer tail so that the way out can be determined by touch.



Alternate method using duct tape "arrow" with single cable tie threaded through the weave of the hawser laid line for back up.



End of line reel with loop to attach next line by larks foot and cut away section of line connecting it to the reel. This is 5 mm line which is "thin" by UK standards. Tying knots underwater is to be avoided due to cold water and poor visibility.



Permanent guidelines usually extend to the surface though their precise starting point is sometimes hidden discretely out of sight of the general public when the dive starts from daylight. In a few sites with mobile rocks near the entrance the line might start inside the cave (e.g. at Porth-yr-Ogof, Wales) or some distance into the cave beyond a gravel restriction (e.g. at Pwll-y-Cwm, Wales). The popular training site of Wookey Hole Caves (Somerset) has clearly labelled lines on the surface and at underwater junctions and generally the same type of line runs throughout the underwater passage. The complex network of passages at Keld Head (Yorkshire) has a variety of lines of different vintages and many junctions which requires the diver to build up their own picture of the cave by repeated visits to gain familiarity with the underwater layout. The nearby Hurtle Pot (Yorkshire), although of simpler development, is plagued by frequent flood events and thus the lines break and change regularly. In Devon, the unusual underwater chamber of Pridhamsleigh Cavern has tensioned climbing ropes which were used to map this large space.

The CDG publishes a quarterly newsletter with accounts of original exploration in the UK and overseas. Details of current or changes in line conditions are also reported and more up to date information may be solicited via the discussion forum on the group's website:

www.cavedivinggroup.org.uk

Australia (text and photos by Peter Buzzacott)

Cave diving in Australia is mainly conducted by sport cave divers, represented by the Cave Divers Association of Australia (CDAA), but also the Australian Speleology Federation (ASF) who are more speleo oriented. Less than 20 cave divers belong to both associations. There are two main regions where cave diving takes place; around the town of Mount Gambier in South Australia and at the southern edge of the desert in Western Australia in a region known as the Nullarbor

(null-arbor, as in no trees). Route marking is generally consistent Australia-wide but an example or two of marks specific to particular caves in each region follows.

Many of the caves in Australia have a main line running through the main passage and this is usually white 3mm braided nylon. The line is looped around rock projections and pulled taught. Australian caves are characterised by almost no flow.

Often a short line will need to be run from the open water to the line inside the cave and divers then place a non-directional marker on the line, near the spool, so it is not removed until everyone is out. It is more common these days for divers to use commercially available cookies but many of the long-time divers still use spring-loaded clothes-pins, marked with their initials. A number of popular caves are unlined and it is common in Australia for the lead diver to run a reel.

Lines are not T'ed in Australia. Where there is an interesting side passage two arrows are placed on the main line to indicate that another line is located a short distance away. The lead diver then attaches his "jump" reel between the arrows and extends his line to join the line in the passage, which he attaches his reel to so there is a continuous line back to the exit. Again, every member of the team places a non-directional marker on the jump line close to the reel, so it will not be removed unless everyone is on the way out.



Pegs are still used as personal markers in Australia.
This one has a temperature logger attached.

While laying line is a good way into an unlined cave, it is recommended in Australia to place a directional arrow every 50 or 100m. In Murra El Elevyn cave in the Nullarbor, for example, there are unlined passages for 200m or more but with three lined side passages nearby, so divers lay 200m of line through the middle of the cave, with an arrow every 50 or 100m, then run jump lines to these side passages.

When running a jump line from an un-marked main line the general procedure is not to put two arrows facing the exit, like you would find on a permanent line, rather the diver puts a single arrow on the main line facing the exit and ties his jump reel into the middle of that arrow.

At the halfway mark between two exits, even if one of those exits lies within an underground chamber, two arrows are placed back-to-back, to indicate that it is equidistant to safety in either direction. Circuits are rare in Australia and only those in Tommy Graham's and Tank Cave have permanent guidelines marking them. There are no known traverses.

Recently kilometres of flooded cave were discovered in the Nullarbor which are filled with extremely delicate dead tree root systems and so a clear route has been marked to preserve these intact. Likewise, in Iddlebidy Cave near Mount Gambier there are delicate clay blocks which are protected by the main line avoiding them.

There is a yellow "Gold Line" in Tank Cave near Mount Gambier, (this is unusual in Australia), and not so unusually a diver may come across some red nylon line used by speleo explorers. Usually the main line is found on the floor but in Cocklebidy Cave the main line runs along the ceiling to minimise decompression following dives in reduced visibility.

Coming soon; Mexico, Florida, the Bahamas and more...



It is usual to run line into the start of the cave in Australia, if not all the way.





Adaptive Algorithms

By Asser Salama



In the 1990s, Professor Albert Bühlmann (1923 – 1994) wanted to reflect the change in blood perfusion to various body organs when the diver is subjected to temperature and/or workload variations, as changes in blood perfusion would alter the inert gas saturation tolerance. In other words, he wanted to develop an algorithm to deal with all the real time variables throughout the dive, not just the depth and time. The result was ZH-L8 ADT, a model using 8 evenly-distributed tissue compartments halftimes ranging from 5 to 640 minutes (for nitrogen). Some of the ‘initial’ halftimes (particularly those of the mid compartments) get altered during the dive to reflect what’s going on with the diver’s body. The idea is that coldness causes vaso-constriction (mainly at the skin and the muscles), thus reduces perfusion. To mathematically simulate this change in perfusion level, the ‘corresponding’ halftimes should be altered.

As you might have guessed, this model is useful for dive computers only. It is implemented in some of Uwatec models. The dive computer has a sensor to monitor the water temperature throughout the dive. The feedback is then sent to the algorithm. One drawback of this approach is that the water temperature is not always a measure of what the diver is feeling. The diver might be wearing a swimsuit and a T-shirt, or a dry suit with a heavy undergarment, so skin temperature would have been a more appropriate indicator. The workload is calculated by monitoring the reduction in tank pressure (gas consumption rate). This is another drawback, as increased consumption rate is not always an indication of elevated workload. The newer, top line models include an optional ‘integrated heart rate monitor’. This is a ‘belt’ that allows the workload calculation to take into account actual blood circulation. In some models, the workload is an adjustable setting, which is good for unfit divers or, for instance, when the diver knows beforehand that there’d be a demanding situation (swimming against current, long surface swim before the descent, etc...).

Based on his personal communication with Professor Albert Bühlmann and Dr. Max Hahn, my friend Dr. Albrecht Salm provided me with some details on which ZH-L16 halftimes would need getting altered to reflect cold and/or increased workload. This enabled me to introduce ZH-L16D in [Ultimate Planner](#). ZH-L16D is a more conservative model than both ZH-L16B and ZH-L16C, and it would generate more suitable schedules for unfit divers or for anticipated colder and/or more demanding dives. For instance, assuming the last stop depth is at 6 meters (20 feet), the total run time of a 30 minute dive on air to 45 meter (150 foot) depth would be 73 minutes (ZH-L16B), 84 minutes (ZH-L16C) or 87 minutes (ZH-L16D).



Greg MacGillivray

A LIFETIME IN FILM
MASTER OF IMAX

BY BRET GILLIAM

Greg MacGillivray may not be a guy with instant name recognition for a lot of divers, but it's a sure bet that you know his work. As the most successful producer/director of large format films in the world, he has been responsible for bringing a variety of compelling documentary IMAX titles to the 70-ft. screen.

From a humble start as a beach rat making low-budget surf films in the 1960s to success as one of Hollywood's most sought after second-unit directors on features such as *The Towering Inferno*, *Big Wednesday*, *Jonathan Livingston Seagull*, and *The Shining*, he changed course again to pioneer the filmmaking process in a new format called IMAX.

MacGillivray changed the way the world looks at documentaries by celebrating the IMAX format to its fullest potential. Whether he raced through the Rock Islands in Palau by speedboat, strapped his camera to an ultra-light plane to soar over towering breaking waves or mountain peaks, took it underwater to capture the beauty of a coral reef, descended into the labyrinth of intricate cave systems, or captured the stark beauty of the Himalayas from the world's tallest mountain summit, MacGillivray brought back the story on film as none other in the genre.

Whether you were introduced to him through his innovative surf films or stumbled on to his work later through *The Living Sea*, *Dolphins*, *Journey Into Amazing Caves*, or *Everest*, it's unlikely that you escaped without a lasting impression of his ability to bring a nature subject to life as never before. His company MacGillivray-Freeman Films helped create three Academy-Award-winning films and produced two more that were nominated for Oscars. His 1976 film *To Fly!* was the highest-grossing documentary of all time until his 1998 film *Everest* recently surpassed it.

I've been a serious MacGillivray fan since seeing his earliest surf films while in high school. In the mid-1960s I was earning some extra money as a quasi-professional surfer on manufacturers' sponsored surf teams. At the U. S. Surfing Championships in 1967, I arrived in Huntington Beach, CA and had the chance to meet Greg and his partner Jim Freeman as they ran around the beach, into the water, and dived into the waves we rode with their 16mm cameras to capture the action. I was 16 and Greg was an ancient 22 at the time, a really old guy. They were the Stephen Spielbergs of the surf world and we all desperately wanted them to point their lenses at us. To end up in one of their surf films was worth serious bragging rights. No luck in my case. So I had to settle for admiring their craft chronicling the real stars. Thirty-six years later, we'd get re-acquainted. Funny, he looked older.

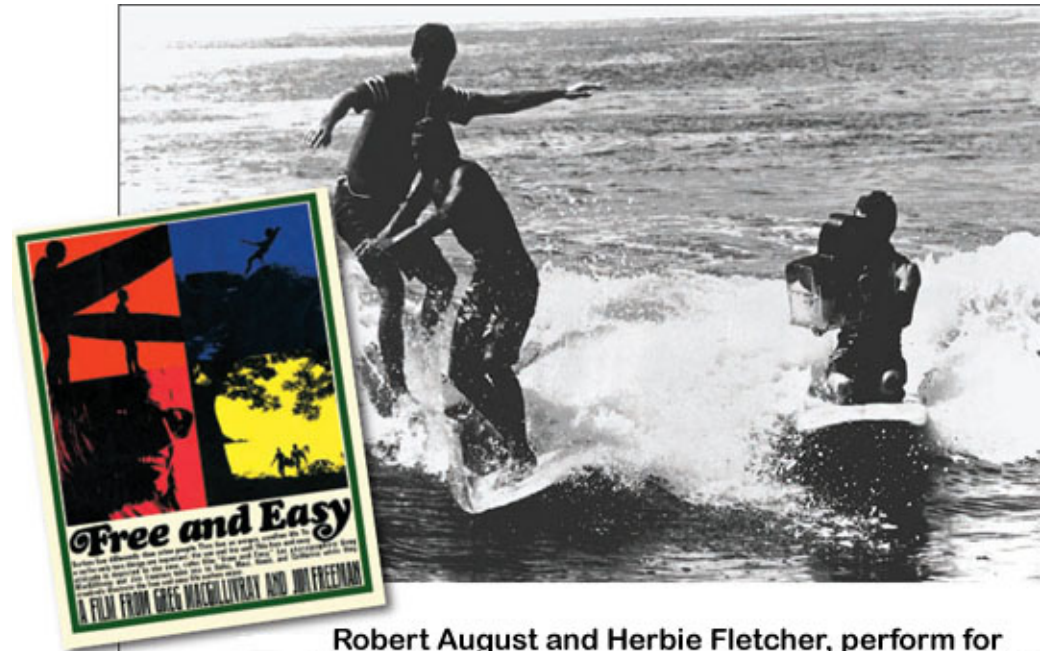
I caught up with MacGillivray at his studio offices in Laguna Beach, California. I arrived at his studio and was ushered by various assistants through a virtual museum of old film equipment, cameras, projectors, tripods, etc., all surrounded by a plethora of awards casually decorating shelves, showcases, and coffee tables. A private screening theatre dominated part of the first floor and the halls were decorated with film posters of prior works. A general atmosphere of professionalism and success was inescapable as dedicated staff swirled around me on endless projects. I was shown into MacGillivray's private corner suite and handed a fresh pastry and a glass of iced tea. I guess I expected Orson Welles or Louis B. Mayer to appear at any moment.

Instead Greg arrived in his bare feet and a comfortable pair of khaki pants with a casual shirt partially unbuttoned looking like he might have just come from a beach party. He was trailed by his beloved Corgi dog, Paige, who joined us for the afternoon interview. We settled in for a long rambling afternoon conversation that kicked off by asking

about his start in surf films and segued on to his most recent film, *Coral Reef Adventure*, a chronicle of an expedition half way around the world to examine the fate of our underwater environment. A more gracious host than can be imagined, I departed several hours later intrigued by his extraordinary talent and his retiring shy demeanor.

You're remembered for your innovative surfing films in the sixties. Memory serves me that you originally intended to be a physics teacher. So surfing was responsible for diverting you from a path of traditional respectability into the film profession?» I went to college at University of California at Santa Barbara and majored in physics with the hopes of becoming a high school teacher. At the time, I was also making my first commercial surfing film. That film took four years to produce. I'd started it when I was a freshman in high school. I had to hitchhike with my camera to surfing spots until I was old enough to drive and then would borrow my parent's car on the weekends to go shooting the surf – either with a surfboard or, when the surf got big and was good quality, I'd pull out my camera, a 16mm Bolex with a 230mm Century telephoto lens, and a nice wooden tripod. Film was my most costly element (my time was free to me!), so I really had to milk that roll of film. Sometimes I would shoot only two minutes of film in a whole eight hour day of sitting on the beach behind my camera ready for the right wave and the right ride to start happening in front of me. I'd track every one of the rides of the best surfers. So it took me four years to make this film because of my meager budget, but it taught me how to plan well, how to use my time and finances to produce a film. When the film came out four years later, it was reviewed well, so it showed a bit of profit. That's when I said to myself: "Hey, I might be able to make a career out of this." People really liked the movie. It was kind of a beatnik, non-traditional film I called *A Cool Wave of Color*. It featured jazz music and lots of colorful animation and it was original, in that it only

featured California surfing – hotdog surfing – the kind of surfing that I felt was the most soulful and artistic. Once my film showed a profit, I decided that I should continue to make films and reinvest the money I was making into more films as I progressed through school.



Robert August and Herbie Fletcher, perform for MacGillivray's camera during *The Sweet Ride*, 1967

Jim Freeman became your partner from the outset. How did you two meet and decide to collaborate instead of working independently?» I met Jim Freeman in 1964 after producing two films: *A Cool Wave of Color* and *The Performers*. Jim had made one surfing film called *Let There Be Surf*. We met each other at a screening in Santa Barbara of his second film. It was a very strange film about surfing called *Outside the Third Dimension*. Jim had the wild idea to produce the film in 3D, 16mm. He shot it in Hawaii and the audience wore glasses. Some of the 3D was actually pretty good but generally the film wasn't a successful artistic endeavor. Jim's effort and perseverance in making this almost impossible-to-produce

movie impressed me particularly from a technical standpoint. We soon became friends. As I was finishing *The Performers*, Jim helped me with technical questions that I had about how to work with the laboratory and make good prints. I didn't know at that time how to make dissolves and fades, and titles in the professional way. I was doing all the animation and titles on my own in front of the camera! So the moment Jim and I became friends, we kept thinking that maybe we could actually make better films, which was our primary goal, if we teamed up. We knew that if we did work together, the profits probably wouldn't be any greater and we'd be splitting them into two pieces rather than just having them alone but we felt that adding quality to the projects was more important than the profits.

In 1966 we took the gamble. We dropped out of college for a year, and traveled for six months through South America with three surfers to tell a story about traveling and surfing in South America. Ecuador, Peru, Chili, Argentina, Uruguay, Brazil and Panama: in most of those locations we were the first people to surf the waves. It was a unique experience for us, quite an exciting adventure for a 22-year-old. We could barely speak the language and were looked at by the South Americans as a total novelty. When we'd paddle out on our surfboards, the town's people would come down to watch, rather flabbergasted by our ability to actually ride waves to shore.

There were five of us, initially, Jim Freeman, me, Dale Struble, Mark Martinson and Paul Strauch, Jr. Paul, after traveling with us through Peru, decided that his business obligations back home in Hawaii were too pressing so he had to drop out of the trip. During our six-month trip, Jim and I really pushed each other in terms of technique, storytelling and the art of what we were doing. In the end each of us improved 100 percent as a filmmaker. We loved talking about films that we had seen and ideas that we had about films and new techniques that we

thought we wanted to try: special editorial and camera techniques, new kinds of lenses and ways to shoot with cameras in slow motion.

Tell us about some of the early surf film experiences.» In the early 1960s, surfing films were presented by the filmmaker himself with a live, personal narration. It was thought that attendance would be far greater if you delivered a "personal account." So, at that time you had to be, not only a good filmmaker and be able to shoot and edit well, put good music with your film, and tell good stories, but you also had to be a personality. You had to be able to stand up in front of the audience and hold the audience's attention with your live narration. It was a lot like Vaudeville or being in a play where you either succeeded or failed based on your own performance. You'd have the music on a tape recorder, which you'd start at the beginning of the film and hope that the tape would stay in close sync to the projector. However, that actually never happened, so you'd always have to be either advancing or retarding the tape as you were talking, so the audience wouldn't hear that something was amiss. It was a bit of a trick, something you had to learn through practice. At the first 10 screenings of my first film, I was a stuttering, nervous moron.

Basically, the narration was pitifully unlistenable because I was so nervous. Even with the lights out, it was a terrifying situation. Eventually, timing and delivery did improve. Believe me, if you were a lousy performer or what you said wasn't very interesting, the audience would tell you; surfers are no shrinking violets. They'd yell out their comments, which then would induce everyone else to laugh or hoot or throw things. Wild nights. Kids were ready for you. There wasn't a lot of drinking, not that kind of wild. In a crowd of 300 people you might have two or three people that had a beer, but basically, they were just ready to have a good time. I went to a number of surf film showings where the film was really almost unwatchable and the



Jim Freeman and Greg, 1967

narrator was irritating. The audience would go bananas! Kids would bring bottle caps that they'd flick with their fingers, sending them sailing like a miniature metal Frisbee, often pinging off the narrator's head. There are countless stories of narrators being pelted by, not only bottle caps, but also paper airplanes and candies. Frisbees and beach balls would get tossed about during the movie. It was pretty crazy.

Before my first film premiered, I remember worrying about what I would do if the crowd went nuts on me. I didn't want that to happen, so I made certain my film was exciting and interesting and had a lot of funny things in it so the audience would not take it out on me.

Around 1962, at a surfing film showing, Walt Phillips was narrating at the Santa Monica Civic in front of about 2,000 people, and reportedly not doing a very good job. About an hour into the program 10 surfers marched down to the front of the auditorium, went up onto the stage, picked him up in his seat, carried him down the steps to the side exit and pitched him outside. The audience clapped and hooted and watched the rest of the film without any narration. That's the kind of crowd at a surfing movie. It was a huge motivation to me to make a really good first film. The fear factor!

Many would say that the 1960s were the golden age of surfing. You had the chance to interact with some of the sports' greatest characters.» I finished my first surf film in 1964 when I was just 18. This was the same year Bruce Brown released *The Endless Summer*. His film was light years ahead of all the other films that had come out before, including mine, and changed the way that the audience looked at surfing films. My film premiered three months before *The Endless Summer*, and it was different, too. The two films kind of complimented each other. Mine was much more personal and different artistically. Bruce's film was much more of a story, much

less of a photographic or artistic exploration, but a story with humor and characters. *The Endless Summer* set tremendous records at the box office in its first and second run. By the next summer, Bruce and Paul Allen had blown the film up to 35mm and were testing it with “normal” film audiences. The film had done that well.

In 1964 there were three main surf filmmakers. Bruce Brown was at the lead. John Severson, who previously was number one, produced films every year from 1959-62. He created a weak film in 1963 called *The Angry Sea*. He dropped out of making surfing films at that stage to devote time to *Surfer*, the brilliant magazine he founded. Bud Browne, who was also a wonderful cinematographer, and had great films, produced the first surfing film in about 1955-56, and then had a film out every year from 1958-62. Bud became a close friend and remains one today. We worked together on *Five Summer Stories* and *The Sunshine Sea* in 1969, 1970 and 1971. Those were the kingpins, the three main surf filmmakers.

Before you and Jim Freeman got into the act, surf films were pretty much a product of long lenses on cameras shot from the beach. What made you decide to try filming from the water, from surfboards and even underwater?» Jim and I were continually challenging one another. Our teamwork allowed us to concentrate on shooting from the water, which was my specialty. Jim would be on shore with a telephoto lens getting what you would call “coverage” of the good surf and the good rides and whatever else was happening on shore while I was in the water with the surfers trying to get new camera angles either by riding a surfboard next to them or by swimming to keep in position and getting the surfers coming by.

It's always a struggle to get the water shots. Your chance of success is about 10 percent in comparison to shooting from the beach. The

result is worth it because you end up with an angle that obviously is completely different and more involving than shooting with a telephoto lens from shore. When you're shooting with a 10mm lens in 16mm, you're getting about a 90-degree view and so you really feel like you're out there swimming or surfing with your stars. We were able to experiment a lot with shooting from the water, getting new camera angles and editing with two cameras so that essentially the ride had more dimension than previous surfing films. With two cameras, obviously, you're able to edit much more interestingly.

How did you get the specialized housings to work with?» The first camera housings that I had to work with, I built myself. In fact, I built all of our housings from 1960 through 1972. Basically, I got a book from a dive shop that Mart Toggweiler had published, a little pamphlet showing how to use Plexiglas, how to cut it, how to form it with a blow torch, how to bend it, how to glue it, how to use the Plexiglas cylinders. I built probably 10 to 15 waterproof housings all in my garage with actually no fancy tools, just whatever I could find at the store. I didn't have any electric saws, so it took me a long time to build these housings. It was a lot of trouble. Oftentimes they leaked and I'd have to modify them. I lost cameras to water damage, so I had to just throw them away.

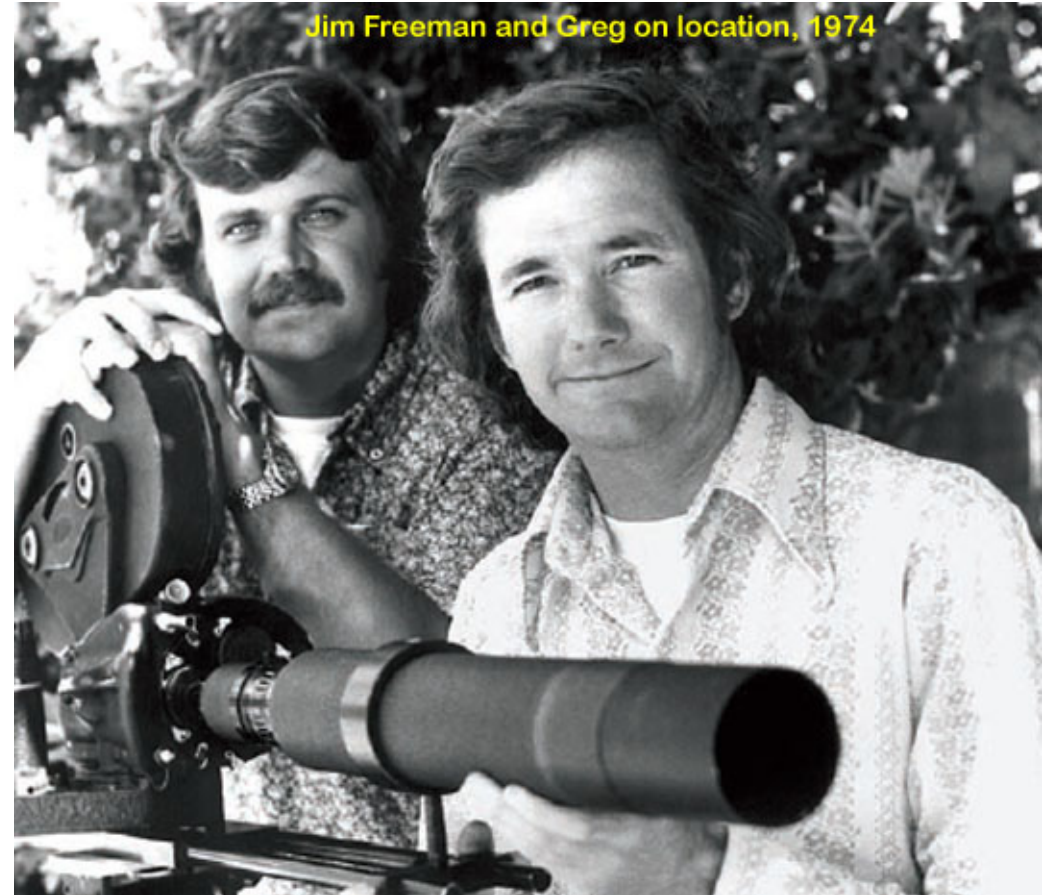
My final camera housing that I built had a highspeed camera and eight pounds of batteries inside of it. We'd found a military 16mm camera that ran 200 frames per second, still only shooting with a 100 feet of film. For our film, *Waves of Change* which came out in 1969, I shot some slow motion water shots with a 10mm lens, which were the first super-slow motion (200 frames a second) shots done in the surfing world. About the same time George Greenough did some slow motion shots with a camera mounted on his back, shooting inside the curl at Rincon. But I believe that we were the first to shoot with a

200-frame per second camera in the surfing world, which really gave a completely new perspective on surfing because water droplets were now hanging in the air catching the light, undulating and moving around in a really interesting way. It gave surfing the kind of beauty that Jim and I always felt that it had.

Although you produced a series of fondly remembered surf films, most everyone would agree that *Five Summer Stories* was the pinnacle of your efforts. Many would say it's the best surf film ever. How did it come about?» Jim and I had decided that we really had done all we could do in the surfing world. We were ready to move on to produce and direct and shoot other kinds of films either for us or for Hollywood. We wanted to make one last surfing film: our tribute to this sport, which we both loved so much. The difficulty for us, though, was that in 1969-71, Jim and I were already working on films with Hollywood studios so our time was limited. We were commissioned to make four 10-minute films for United Artists that were shown with the James Bond films as short entertainments. We were also making films for the educational market like *Catch the Joy*, a dune buggy film. We'd already shot a few television commercials and had some assignments on feature films, such as *The Sweet Ride* for 20th Century Fox and a host of other movies.

In order to make our final surfing film, I came up with the idea of doing a series of stories so that we could spend three weeks working on one story and complete it—and then go off on a Hollywood assignment. We'd then come back later and make another film story. I sat down and wrote out five stories that I thought would be interesting. The thrust of the film was the idea that surfing is almost a religious experience and that the spiritual side of surfing is significant to people who surf. The film started with the creation of Earth and waves and people and the final sequence was, what we call, “The End of the World.”

Heaven's Gift to Man: The Tunnel of Love was the film's epilogue filmed at Pipeline inside the tube. It was a paean to our love of the ocean. We used the “tunnel of love” as a metaphor for our personal love of the ocean.



It took us more than two years to complete the film. We worked on it with Bud Browne, who, because of our obligations with other films, would go to Hawaii for two or three months at a time and shoot film and send it back to us. We'd look at his footage, make suggestions and he'd just continue on. He was doing water shots with that same 200-frame per second military camera that he then put into a special

rubberized, waterproof housing. He could actually swim it out at Pipeline and get great, super-slow motion shots. That was one big innovation for the film: shooting in 10 to 15-ft. surf at Pipeline, which is probably the most treacherous surfing area with the most lethal impact zone of any surfing spot in the world. Bud got amazing shots in horrendous conditions. It's amazing to me that he wasn't killed or seriously injured.

Five Summer Stories premiered March 24 and 25th, 1972, at the Santa Monica Civic on a Friday and Saturday night. It was an amazing event. It was the first surfing movie released with stereophonic synchronous sound. We equipped the theaters with special speakers – huge full-range speakers – and the film soundtrack was played on a 100-lb. piece of equipment that we'd lug up into the projection booth. It ran in sync with the projector, if you punched the projector and the tape recorder start buttons at exactly the same time. Otherwise, you had to try to adjust as the film started screening. The sound for every performance was unbelievable. It was far superior to any sound in any movie theater at that particular time, comparable or even better than the 70mm six-track sound reproduction that was done in Hollywood and New York City. It was something special to watch this movie when it was shown with stereophonic sound, which was the case in the majority of the screenings for the seven-year period that the film ran.

So Jim and I produced this 92-minute film, which was released in 1972 and it became an instant classic. All the attendance records which were established previously by *The Endless Summer* in 16mm eight years earlier, all the records that were established by *Free and Easy* or by *Waves of Change*, all those records were broken by *Five Summer Stories*. It was a knockout of a film. After our first run of the movie, which was from March 1972 through September 1972, we

continued to re-release the film every six months or every year for the next seven years the demand for the film was so great. In 1974, in its re-release, we added a new sequence, a new story, and then in 1976, we added a couple of new sequences including one of the last films that Jim Freeman worked on called *The Magic Rolling Board*, a film about skateboarding. In 1977, I released the film with a sequence on Shaun Tomson who at that time was the world champion and one of the greatest ambassadors to the sport of surfing.

The film was innovative, it was artistic, and it was controversial. One of our main objectives was to leave the surfing world with a few things to think about. We were very critical about environmental issues, the way that the public was treating the ocean, and we also were critical about the way surfers were treated, particularly by surfing contests and advertisers who would use surfers to their own advantage and not really compensate them in any way. The film was also the first, or one of the first surfing films to pay surfers, not only to be in it, but also gave surfers 15 percent of the profits of the film. The surfer profit was actually divided in a very carefully orchestrated formula between the 60 surfers who were in the movie. Every year, each one of those surfers would get a check in the mail for his or her participation. That was new. Other surfing movies had paid surfers in the past (including our films), but this is the first time that every surfer who was in the film got a paycheck in relationship to the number of seconds that he or she was on screen.

Our criticism of surfing contests, for example, produced quite a reaction at the Huntington Beach Surfing Championship and prompted Huntington to begin paying surfers prize money. Our actions were well appreciated by the surfers and gave them the opportunity to ask other surf film producers to at least help them out in some way during the production of a film.

You ended up releasing several editions of that film over the years and its popularity has achieved almost cult status. Was it your best surf themed film?» Sure, I think *Five Summer Stories* was our best surfing film. It was insightful, interesting, entertaining, accurate and provided the audience with a new way technically to look at surfing. The stories were good and contained interesting, real-life characters – all non-fiction. The photography was unique, particularly the slow motion and close-up photography. Also, the music and the sound reproduction were both very high quality. Regarding the film's music, we were fortunate to have a friendship with Bruce Johnston, who is in the *Beach Boys* and who also is a surfer. We'd announced the fact that we were going to make *Five Summer Stories* as our last surfing film, in fact it was subtitled *The Last Surfing Movie*, kind of as a takeoff on *The Last Picture Show*. When Bruce heard about the film coming out he talked to the other *Beach Boys* and offered us their entire library if we wanted to use it. That was incredible. Even though some of the early *Beach Boys*' hits were exploitative of the surfing genre, the music that the *Beach Boys* were doing in the 1970s was just as creative and more interesting than their early work. It was a wonderful opportunity to use their brilliant music particularly from the Surf's Up album, the songs *Feel Flows and Surf's Up*, and from the *Holland* album, the song *Sail On Sailor*. Beautiful music.

The success of the film, as well as the success of our previous surfing films and the films that we were making for Hollywood, really built a sturdy foundation for our company, benefiting us in a number of ways. Not only do we have no debt and no big concerns from a financial standpoint, we also own all of our own film equipment free and clear. We can make sure it's the finest equipment and is maintained in the very, very best manner so that when we go out and shoot, we can rely on the lenses and the cameras to be performing to an A-plus level. That's why in our IMAX theatre films, all of the scenes are absolutely

crystal-sharp and steady. Quality of the image on screen is hugely important to us, and we're able to achieve that because of the strong foundation that the surf films built for our company.

By the early 1970s, you had widened your horizons beyond the surf genre to include work for mainstream Hollywood. How did you make that connection, and what kind of work did Hollywood push your way?» Beginning in 1970, Jim and I decided to get more involved with Hollywood film productions. We began shooting *Jonathan Livingston Seagull*, the Paramount feature film from Richard Bach's book, which was the biggest selling book of the year. Our company was in charge of shooting all the scenes of seagulls in the air while Jack Couffer was the Director of Photography and was responsible for shooting all the beautiful images of the seagulls walking on the ground and talking to one another. The reason that Jim and I wanted to do films outside of surfing was that we felt that we'd done, by 1970, just about everything that we possibly could do. Any future films would be going over the same ground again. We were more interested in challenging our artistic abilities with new subjects and new ways to express ourselves in film. Working with Hollywood was a good way to learn and a great way to challenge ourselves.

***Big Wednesday* came along in 1978 as Hollywood's attempt to capture the surf lifestyle in an authentic script instead of the usual Gidget garbage. How did you get involved?»** *Big Wednesday*, which we photographed in 1977 and 1978, was a film with Warner Bros. and John Milius as the director and writer. Another surfer, Denny Auberg was John's co-writer. I was asked to produce and direct all of the surfing sequences, which were sprinkled throughout the screenplay. So for over a year, I drove back and forth, once or twice a week, to Hollywood to have meetings with John Milius and his A-Team Production Company to plan and shoot the surfing sequences. Milius

brought a lot to the project, including interesting ways to compose the surfing shots and together we designed the storyboards for each of the surfing sequences.

What was John Milius like to work with?» John was really a lot of fun to work with because he is such an encyclopedia of historical knowledge. He loves to expound with story after story about Teddy Roosevelt and the Roughriders, Jack London, and stories about filmmakers and films. Through the production, John and I became good friends. John Milius, at the time, was coming off of a big success with *The Wind and the Lion*, (starring Sean Connery, Candice Bergen, and Brian Keith), which was a beautifully written film with brilliant cinematography, great editing and a beautiful score by Jerry Goldsmith. Because of that, John had quite a bit of clout with the Warner Bros. studio, so when I needed to stay in Hawaii for an extra five or six weeks to get the best footage possible, he was able to push the issue with Warners to get their approval. This allowed us to jointly make the surfing sequences better than they were budgeted to be and better than the studio would have normally approved.

I have to say that John really stuck by the project even though he was so heavily involved with other productions that were ongoing with his production company, including Steven Spielberg's film, *1941*, which was going into production at A-Team about the same time. John's a great guy and a brilliant writer.

Were you given carte blanche to create the live surf scenes using real professional surfers?» We used real surfers to act as stunt doubles, but John did find main characters that actually had surfing experience. Jan-Michael Vincent and William Katt were good surfers and became cast in the leading roles. Gary Busey, who played the third main character, was from Oklahoma and had never touched a

surfboard in his life. We sent him more or less to surfing school for about two weeks and then took him to El Salvador when we were shooting for seven weeks down there. He was a total trooper. He tried his hardest to learn to paddle, catch waves, stand up, ride to shore, just so we could intercut his face with the backgrounds and the stunt double work, which was being done with surfers who looked like him. The surfers that actually rode the biggest waves were: Bill Hamilton, Jay Riddle and Jackie Dunn rode for Jan Michael Vincent. Bill Hamilton, who is one of my favorite people in the world, traveled with us everywhere, to El Salvador, to The Ranch, and to Hawaii. He surfed brilliantly in all locations. To stunt double for Billy Katt was Peter Townsend who looked almost identical to Bill Katt and was just a perfect stunt double. Doubling for Gary Busey was Ian Cairns. All of these surfers were completely enjoyable to work with and we really bonded over the 20 weeks we had to shoot all of the sequences for the film.

Getting the shots, however, was nothing but a lot of trouble. In order to get the coverage, I had to have a group of photographers, some of whom, frankly, just did not match up to the job. The guys who really came through for the production and who shot 95 percent of the surfing shots used in the film were five: George Greenough, who shot brilliantly from the water; Spyder Wills who shoots with a telephoto lens better than anyone else in the world; and Bud Browne who can get the camera inside the curl deeper and in the impact zone better than anyone else alive; and Jack Willoughby and Roger Brown, each who shot brilliantly from the helicopter.

The film followed the lives of three surfers from high school to Vietnam and into adulthood culminating in the legendary big surf conditions that reunited them after difficult separations and personal failures. It was simultaneously rowdy and immature yet

sensitive and hopeful. Did it capture the soul of surfing as you might have written it?» I loved the script and particularly loved the idea of the four periods of growth and maturity of each character. There were sentimental moments which may have been too exaggerated, which is kind of a Milius trademark, and which became heavily scrutinized by film critics across the country. For me, the film captured the freshness and spontaneity of the early 1960s surfing scene. It had that naive, “we will live forever” attitude, which I think surfers believed in the ’60s. *Big Wednesday* premiered in May 1978. It was two years after Jim’s death and, for me, it was kind of a sentimental reflection on the time that Jim and I spent together shooting surfing in the 1960s and the early 1970s. It gave me a chance to say goodbye to surfing films and to Jim.

Enter the world of IMAX with *To Fly!* How did that film evolve?» In 1974, the Smithsonian Institution’s National Air and Space Museum called us to say they were building a new museum in Washington D.C. on the mall. They were putting an IMAX theatre into the museum and wondering if we were interested in producing and directing a film for that theater. In our view, the Smithsonian called us because we had co-photographed *Jonathan Livingston Seagull*, which earned an Academy Award nomination for Best Photography. We also just worked on the aerial photography for *The Towering Inferno*, which in 1973 was the biggest box office hit of the year. So they came to us because of our experience with shooting from helicopters and airplanes. We had heard about the IMAX film format through technical journals, which we read with relish every month and were delighted to be able to be involved in an IMAX theatre film.

The Smithsonian and their consultants, Francis Thompson, Inc., had written a short treatment for the film which Jim and I read and felt was workable, but not perfect. We took the treatment and shaped it

into a chronological story that contained humor, comical fictitious characters, and mixed it with a little bit of flight history. At that time, the director of the Air and Space Museum, Astronaut Mike Collins, told me that even though the film was to premiere in America’s Bicentennial Year of 1976, celebrating 200 years of American government, he did not want the film to be a historical journey through flight with dates and facts and people like the Wright Brothers and Charles Lindbergh. He said to us, “I have plenty of historical plaques on the wall of my museum; please give me a film that entertains, and allows the audience to be amazed by flight.”

We took that suggestion and ran with it. It fit perfectly with the way that we had been making movies all through our surfing years: enthrall an audience with great entertainment and photography, inventive music, and images the audience had never seen before. Put the audience through the experience of flying. Give the audience the thrill of taking to the air.

So for the next two years, Jim and I devoted ourselves, and our miniscule team to *To Fly!* Cindy Huston, who was Jim’s girlfriend, acted as the camera assistant; Barbara Smith, who was my girlfriend, became the production assistant, craft service specialist, still photographer and behind the scenes cinematographer; Bill Bennett came along as a production manager with Jeff Blyth, who was the unit production manager; Brad Ohlund, was the second assistant camera-person; and Phil Schwartz was our first assistant camera person. That was our team. We traveled for a period of about 20 weeks to shoot *To Fly!*

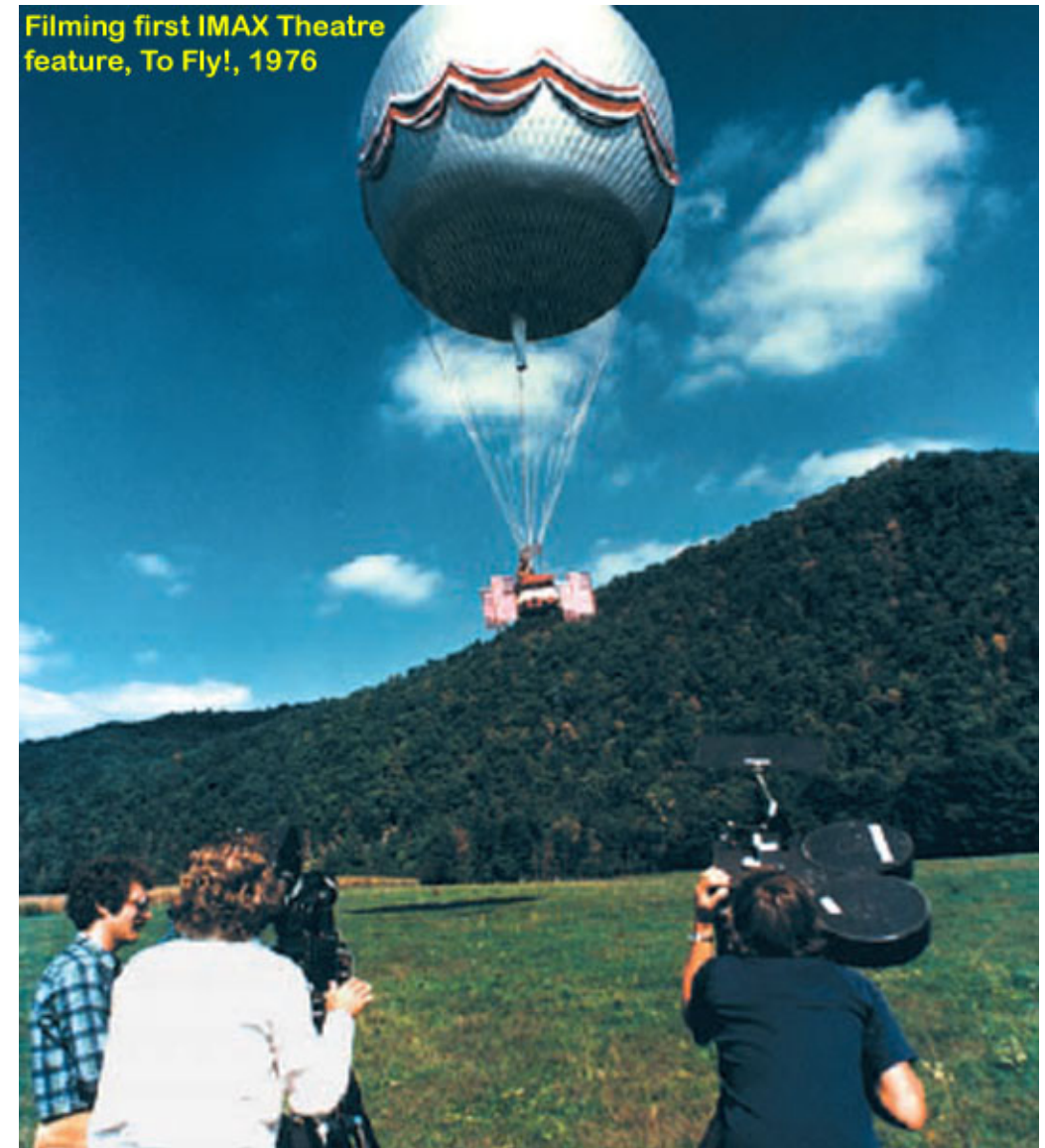
When Jim and I had the film completed, I remember us both sitting on the curb, outside the Todd-AO mixing facility in downtown Hollywood, at eight o’clock on a summer’s evening. We talked endlessly about what we should do after this IMAX theatre film was

released. We talked about the string of television commercials that we were contracted to do for Kodak and how exciting they were. We talked about ideas that we had for feature films, even films in a revolutionary, new 3D technique called Stereovision. We were swimming with ideas of what to do with our future. In one week we were set to premiere *To Fly!*, probably the best film that we'd worked on together in our 11 years as partners.

As Jim left for Bishop, California to scout locations for the Kodak commercials, I flew back to Washington D.C. to run the film and check the soundtrack one last time before the major premiere. With me were Jim's mother and his sister, my parents, Jim's girlfriend, my girlfriend, our helicopter pilot and several other friends. We were all there to celebrate this new episode in our life, a new direction for us in the IMAX theatre format. On our second day in Washington I got a telephone call from Bill Bennett, who was there in Bishop. Jim had crashed in a helicopter with three other people, high in the mountains while scouting for those locations that we had planned to film in the coming week. Jim and the agency producer were killed and the pilot and the agency co-producer were able to crawl away from the helicopter before it burned.

I thought my life had ended too. It took me weeks before I could really even talk about the tragedy and it took me months before I even cared to face work. With the strength of my girlfriend Barbara, who is now my wife, and with the help of close friends like Bill Bennett, and Cindy, Jim's girlfriend, I was able to get through the pain of the loss and continue to make films. After his death, I dedicated myself to creating films in Jim's honor and I decided to leave his name, the Freeman name, on our company as a tribute to his artistry and his contribution to what our company had become. I often reflect on what a loss Jim's death has been and wonder what brilliance and artistry he

would have brought to our films had he lived.



***To Fly!* set a few box office marks along the way.»** Thankfully, *To Fly!*, the final film that Jim worked on, became an enormous critical and financial hit. At the Smithsonian, the first year running, over a million people saw it in one theater alone. It was producing huge

attendance numbers and ran 14 times per day. Through that entire year, the theater was filled to over 80 percent capacity. After the end of that year, it is said that every museum in the world wanted an IMAX theatre because of the potential for profit and good educational communication, because of the huge success of *To Fly!* Today, 25 years after the premiere, *To Fly!* has been seen by over 15 million people at the Smithsonian Institution alone and has grossed over \$110 million worldwide. It has been said that in all its versions, 15/70, 35mm, 16mm, and videocassette, as well as its television exposure, *To Fly!* has been seen by over 100 million people. Up until this past month, when Everest overtook *To Fly!* in box office receipts, *To Fly!* has been the highest grossing documentary film of all time.

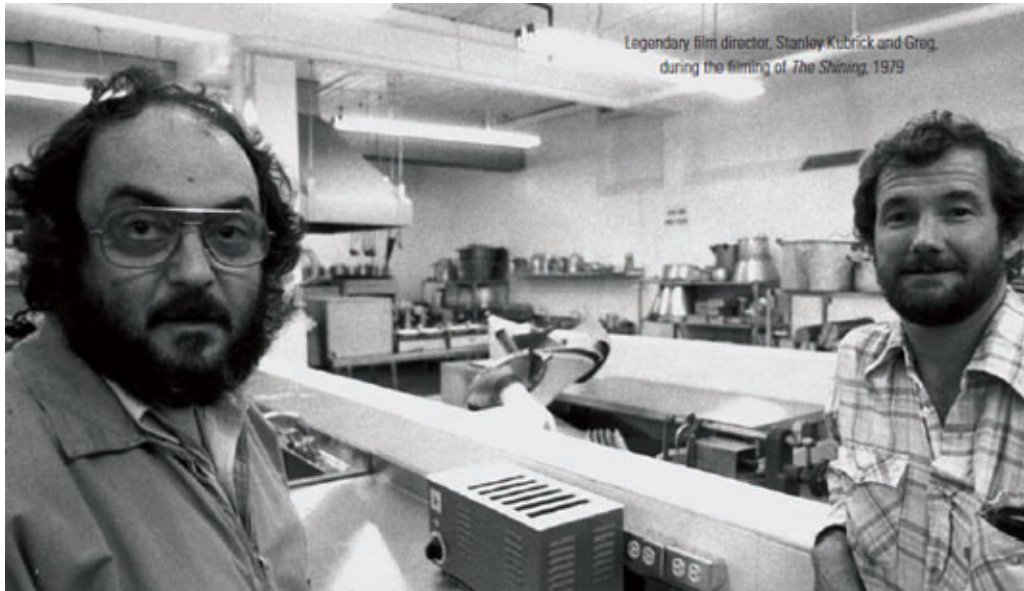
What brought you into Kubrick's production of *The Shining* and what was he like to work with?» In 1975, Jim and I worked for Twentieth Century Fox on the production of *Skyriders*. We directed and shot hang gliding and stunt sequences in Greece for this feature film with James Coburn and Robert Culp. My assistant director for that feature film was an Englishman named Brian Cooke. Brian, Jim and I worked together closely with our 25-person second unit crew for over nine weeks in Greece under very, very trying conditions. I'd known that Brian was also the assistant director for Stanley Kubrick on many of Kubrick's films, but in the last week of shooting in Greece, Brian came to me and asked if I'd mind if he told Stanley Kubrick about us and wondered if we were interested in working on Kubrick's next film. I was knocked over because Kubrick was my favorite feature film director. *A Clockwork Orange* and *2001: A Space Odyssey* were two of my favorite movies and *Barry Lyndon*, I felt, was a photographic masterpiece. I, of course, said that I'd love to be able to contribute in any way that I possibly could.

Well, about a year and a half later, after Jim had been killed in the

helicopter crash, one afternoon our company secretary called up to me and said that a man by the name of Stanley Kubrick was on the phone and wondered if I wanted to talk to him. I thought it was probably a joke, that it was some friend of mine calling. I never imagined it was really Stanley Kubrick. But it was. Evidently he was the kind of man who would make all of his own calls, night or day, and who produced his films with a very small crew, with very little overhead but worked exceedingly hard and long to make the films as brilliant and innovative as possible. He must have liked what I said. In fact, he told Brian that he thought that I sounded humble and well versed in cinema and the technical side of filmmaking and that he wanted me to be the second unit director and cinematographer for all of the scenes that would be shot on *The Shining* outside of London. Well, for me, this was a tremendous opportunity because I not only would be working with one of my filmmaking idols, but I would be working with him directly, and be able to learn from him while I worked.

The actual production was even better than I expected. Our first assignment was to try to develop the opening of the film, which was to establish Jack Nicholson and his family driving in a yellow Volkswagen Bug through the mountains up to the Overlook Hotel. We decided to shoot in Glacier National Park and went there in September for a two-week shoot. Once a week, I sent the raw footage, undeveloped, to the Technicolor Lab in London where Kubrick would have it processed and then he would look at the work print of every foot of film that we shot. After one week, he called me and complimented me and said he loved the footage, he loved the photographic techniques that we were utilizing, including the helicopter mount where you looked forward from the helicopter rather than out the door with a side view and that he felt that these images would match really beautifully with the Steadicam, forward moving shots that he was using elsewhere in the film.

Kubrick was shooting the film in London on incredibly complex and enormous sets depicting the expansive Overlook Hotel, all built on sound stages in Borehamwood, England. It was the Elstree Studios Lot and Kubrick had essentially taken over the entire studio. He planned to shoot there for more than a year. He was, at that point, probably three months into shooting in England. Getting these dailies showing actual outdoor locations was probably a breath of fresh air for Kubrick and for his technical staff. He called me after one week, and then again after one and a half weeks, and then two weeks. I kept begging him for more time because the location was absolutely stunning but the lighting wasn't good enough. Kubrick trusted me, and he allowed us to stay a third week, then a fourth. On our final day in the fourth week we got the day I had been waiting for.



We'd practiced at least 20 times a very complicated one and a half minute shot from the helicopter where the helicopter comes over a ridge and then down a mountain, the Volkswagen being almost a speck on the horizon. The helicopter then flies up quickly behind the

Volkswagen, tucking in behind it. As the Volkswagen makes a right-hand turn on a curve in the road, the helicopter continues out over the lake. As you take in the beautiful scenery, you've almost completely forgotten about the Volkswagen, when it comes into view suddenly from behind some trees. This shot required perfect second-by-second timing, beautiful sunrise lighting, and glassy conditions on the lake. We finally achieved it on the last day of the last week at 10 minutes after sunrise. The lake was glassy smooth and the fall colors were turning all of the aspen and maple trees in the region a bright yellow. It was probably the single most beautiful motion picture shot that I had ever done in my life. When Kubrick saw it, he was ecstatic. He called me and wanted me to rush over to England to see the shot and to meet the rest of the crew, Jack Nicholson, Shelley Duvall, legendary cinematographer John Alcott and to bask in the glory of what we had done in Glacier National Park.

So I did that and had a wonderful time over a two-week period, being with Kubrick, having lunch and having dinner with him almost daily, spending 12-to-14 hours a day on the set with him and getting to know the way that he made films. I've often said that I probably learned more in the year that I worked on *The Shining* than I learned in any five years through the rest of my career. One thing most people forget about Kubrick is his terrific sense of humor. He loved to laugh as much as he loved filmmaking. For a filmmaker who used words so sparingly in his films (like *2001: A Space Odyssey*), words came very easily and quickly to him, revealing his active, alert mind. It was fun to be around him and conversation with him was delightful. Stanley was intensely interested in nearly everything. Because I knew filmmaking, we talked about emerging film systems, like IMAX, film emulsions, lenses that we each owned, recent films we'd seen, and what was going on in Hollywood. Our love of film was what we shared throughout our entire association.

Months after I finished working on *The Shining* I got a call from his executive producer, Kubrick's brother-in-law Jan Harlan, who said that Stanley wanted to give me more credit on the film than I'd requested. He loved the work I did for him and he wanted to give me a credit at both the beginning and ending of the film. I was astonished. In Hollywood, it's common to fight for your credit when you negotiate your deal beforehand. Then, later, you have to fight when the producer or director wants to rob you of your credit so it'll appear as if he's done everything with no one else's help. Here, the world's most famous director wanted me to have an additional credit, over and above what my contract called for. I was honored and humbled by his generosity. (This was also from a director who had conducted a very public fight with Douglas Trumbull, because Kubrick felt that Trumbull was over-promoting and stretching his credit on *2001: A Space Odyssey*.) He did this but it sounds petty!

I was very sad when he died at age 70 a couple of years ago. A month after his death, I attended a "Tribute to Kubrick" at the Director's Guild Theatre in Hollywood. As part of the tribute, they showed a collection of classic Kubrick moments in film. Our long and beautiful helicopter shot for *The Shining* was the first image they showed. It made me feel so fortunate to have worked with him. Kubrick's films and personality were so unusual, outstanding and thought provoking that they caused everyone to re-evaluate – to search further within themselves and to improve. You could not meet him, even casually, without sharing at least one laugh and without him providing one remarkably insightful comment. What set him apart was that he was alive with and tuned in to all possibilities. Working with him was an exploration through a forest of ideas and visions, always seeking a solution that was not only best, but also most original. Millions of fans, including me, miss him and his inventive films.

How about Jack Nicholson?» I first met Nicholson in London on a Saturday night. It was 8 p.m. on the studio sound stage. The film crew had just finished 28 takes of a scene of Nicholson removing a vacuum tube from the Overlook Hotel's two-way radio. In the film, Nicholson takes the tube out so that Shelley Duvall, Mrs. Jack Torrance, can't call for help when Jack becomes a little deranged. After 28 takes and it was only a close up of Nicholson's hand. Jack kept making jokes about how Stanley should use a "hand double" and Jack could go out on his Saturday night date, as he had planned. Stanley said, "No, the audience would notice – and, anyway, only you, Jack, could remove a tube so villainously." Then, they'd all laugh.

Actually, Stanley did not want to pay a hand double (he was a very frugal filmmaker), and felt that if he could stay late, Jack could too. Both Jack and Stanley seemed very respectful of each other, knowing that they each wanted to push the limits on his craft in sometimes invisible or less-than-obvious ways. Recently, I was pleased to notice that Nicholson's *The Shining* performance was included in a film magazine's list of the "50 Best, but Un-Awarded Performances" of 100 years of cinema history, no doubt because of the hand close-up shot. (laughing)

Three months later, on my second visit to *The Shining* stage in London, Nicholson immediately asked me about all the up-to-date news about the Lakers, the football teams and whatever else I knew about Hollywood films. He was hungry for any news from America. The crew had been isolated, pre-CNN, for half-a-year. It was great fun talking with Nicholson, Shelley Duvall and Danny Lloyd, who was playing the boy with "the shining." We all knew we were working with a master. It was long, difficult work, but we all recognized that we could learn something valuable from the experience and from Kubrick and that the film would be beautiful and have a lasting quality.

Other films like *Jonathan Livingston Seagull* and *Towering Inferno* kept your hand in Hollywood films. Did you like that work as much as the documentary films?» The first Hollywood film that we became involved with was in 1967 just after Jim and I had taken a three-week, nine city tour of the East coast showing our film, *Free and Easy*, a 16mm, 90-minute surfing documentary featuring four main characters and their surfing exploits on three islands in Hawaii and in California. Right after we got back from that trip, we had a call from the offices of the head of production at Twentieth Century Fox, Richard Zanuck. He was in charge of a production called *The Sweet Ride*. The screenwriter had written in several short surfing sequences that would be taking place somewhere near the Malibu, Southern California area. They'd seen our film, *Free and Easy*, when it was showing in Santa Monica earlier in the summer and they felt that we would be the best two people to manage, direct and shoot the surfing sequences of about five minutes total for their feature film.

We discussed the show with the production manager, a wonderful man of great experience, Chico Day. Chico was the brother of the famous Hollywood actor, Gilbert Roland, and had run the production on probably over 100 big Hollywood movies and so Chico was very well known. He wanted to make sure the experience that we'd have with the Hollywood studios would be a pleasant one for us. We drove up to Hollywood, which was always an ordeal because it was at least an hour and a half on the road and the traffic was horrendous to the Twentieth Century Fox Studios in Century City.

We went to the production offices, in this incredibly beautiful old Hollywood studio and were ushered into Zanuck's main office. He was sitting behind an enormous desk, a small man, probably five-foot-five, but with a tremendous amount of confidence because his father, Darryl Zanuck was one of the founders of the studio. To say the

least, we were very intimidated by the surroundings but Chico tried to make us feel comfortable. Chico ran the meeting and explained what the film was and what they wanted us to do and they asked how much we would charge for the two to three week job. Without flinching, because Jim had obviously prepared for this question before we went to Hollywood, Freeman said, "\$7,500." Now, \$7,500 at that time was like \$750,000 today. In other words, this would have been more than 10 times what we'd ever made for that period of time working as hard as we'd been working over the past seven or eight years.

Richard Zanuck cleared his throat and said, "\$7,500?" And Chico gave us kind of a sharp look like, gee, maybe you're reaching too far. But Freeman said, "Yes, \$7,500. We feel that we can do the best job of anyone and we also feel that we'll end up saving you at least \$7,500 because we'll do everything right the first time." Zanuck shuffled around papers on his desk and he looked up at us and said, "Boys, I just don't think we have the budget for that kind of expenditure. Thank you very much for driving all the way up here, it's been pleasant meeting you, and I hope we can work together on some future project, but thank you."

Well, Jim and I were completely devastated because we'd really needed the \$7,500 and we thought that we'd completely blown it with Zanuck. We left the office not really knowing what else to do. Just as we made it to our car in the parking lot down below Zanuck's third-story office, Chico came running from the building yelling at us to wait. When he came up, he said, with a big grin on his face: "Nice work, guys. I've never seen anyone get the best of Zanuck before, but he's gone for it. After you left, he said, well, I like those guys. They stick to their guns. I think they can save us at least what we're going to pay them. Chico, go tell them they have the job."

So that was our first experience with the big Hollywood studios. What made the story even more fun is that we talked Chico and his staff into renting the Hollister Ranch, particularly “Rights and Lefts” which is a beautiful peak wave surfing spot. The Hollister Ranch is a private community and to be able to get in there to surf is next to impossible. It has some of the best waves in California. Jim and I and the rest of the surfers had a great time. I have to say that the people at Twentieth Century Fox, particularly Chico Day, were enormously helpful and professional and taught the two of us a lot about the way movies are made. Though the Hollywood films continued to lure us away from Laguna Beach, our real heart was in making documentary films about subjects that we cared about. On each one of the Hollywood shows, we would learn many new things, both technically and artistically. It was clear that Jim and I really wanted to make films that would treat the audience to real experiences that were much more involving than the artificial and phony Hollywood moments. So, when IMAX opportunities came knocking and the Smithsonian decided that they wanted us to make a film in this large format, our sights were set.

IMAX theatre films continued to beckon and became your personal arena of excellence. Tell us about what makes an IMAX film special.» It’s reality filmmaking to the extreme! As a filmmaker, to be able to see your images big, beautiful and crystal clear is very, very rewarding. I wouldn’t want to film in any other format. Also, it’s about the positive messages that IMAX theatre films contain. Because this genre grew up in the museum world, our films are designed for families who are spending the day together wanting to have fun and to learn something along the way. It’s a real pleasure to work in a format that is so positive. These big, beautiful images are educational and inspirational tools. Our world is an amazing place and this format reveals that like no other can.

How did the format originate?» The format began because of a need at a World’s Fair. In the late ’60s, World’s Fairs were the rage and every pavilion tried to develop a new way to entertain and educate the audience. One of the main factors was that perhaps as many as 3,000 people would go through a pavilion every hour over the 16 hours a day. Film formats became an important way to communicate and entertain because they are repeatable and require only a small staff to run 20-to-40 times a day. So, the World’s Fairs in New York in 1964 and Montreal in 1967 had all kinds of lavish and creative film formats utilizing many screens, and formats like CircleVision and 3D that gave the audience a completely new way to experience film. One of the filmmakers who had become expert in making these films was Graeme Ferguson, a Canadian who had a big hit at the Montreal Fair. He was then asked to produce an unusual film for a 1970 Fair in Japan. He sold to the Japanese the idea that it would be a one-film, huge-format experience, projected onto a screen six-to-seven stories tall and over 100-feet wide. In order to fill this large screen with an image of clarity, sharpness and steadiness, a complete new projector and camera would have to be constructed. Bill Shaw, a bicycle maker from Canada, was chosen to build this new projector. That’s the way IMAX was initially started.

By 1974, when Jim and I got the call from the Smithsonian, there were three theaters in existence. One of those theaters was a dome theater in San Diego and the other two were flat-screen theaters, one in Toronto and one in Spokane. When we started *To Fly!* in 1974, there was only one camera available. We were concerned that if that camera broke, both our film and another IMAX Theatre film being produced for the Bicentennial, *American Moments* would be compromised. *American Moments*, produced by Francis Thompson Inc., was to be part of Philadelphia’s Bicentennial celebration. It would premiere in an enormous 800-seat IMAX theatre, which was



destined to be torn down after one year. Jim went to Canada and discussed the camera situation with Graeme Ferguson and Bill Shaw and their partner, Robert Kerr. Jim proposed to them to produce three new cameras with a list of improvements based on our experience owning and operating various other cameras. Six months later, IMAX Corporation delivered three cameras, which we and the Philadelphia film used for the next year and a half of production.

Producing and directing *To Fly!* was a new and interesting experience for Jim and me. We were given such a small budget (\$590,000) and told that we couldn't go over that budget by even a dime. We carefully constructed a script and storyboard and set out to shoot only the scenes that related exactly to what we had drawn in the storyboard, the template for the film. It worked, because the script that we had written was tight, comprehensible, filled with exciting moments and new camera tricks that would engage the audience, and had a style similar to the carefree surfing films that Jim and I had created over the previous 10 years. Our style made *To Fly!* a film that was different from any other film released at that time. There were at least 10 significant films released as a tribute to the Bicentennial, each having a budget far surpassing our \$590,000.

To Fly! was completely different than any of the other IMAX theatre films that we would ever produce. In 1976, when the film premiered, very few people had seen an IMAX Theatre film before. So what we wanted to do is to give the audience a treat to the size, the clarity, the dimension of sound, the visceral involvement and thrilling moments that can be felt when watching this kind of a film. Only an IMAX theatre image, with clarity derived by shooting film that is 10-times larger per frame than conventional 35mm motion pictures, gives the audience a true-to-life, you-are-there sensation. Probably no other film format, except for Cinerama, which was a huge hit between 1953

and 1960, can deliver this kind of exceptional involvement in the image.

Jim and I designed ways to thrill the audience with the big screen, including having a train, an 1890 steam locomotive, roar headlong, straight into the audience, landing in its lap! We filmed the scene by putting a mirror on the track, and shooting with two cameras into that mirror, as the train roared down the tracks and it plowed into the mirror, breaking it into a million pieces. With Nelson Tyler's help, we also built two new helicopter mounts, which would enable us to get steady and smooth helicopter shots from two positions. To get the audience in the air, we made mounts to go on to the 747, and also on to Art Scholl's chipmunk monoplane. In addition to the technical innovations, I think the central reason that the film became such an enormous hit was the charm of the storytelling. Because the audience would be in Washington D.C. on vacation, sitting in a theater, in a museum with a million facts, we decided to make the film fun. We took what we knew from our surfing films and we wrote a film that revolved around characters who were fictitious, but humorous representations of real aviators in history. From the first one and a half minutes of the film, the audience realized that this film was a comedy and that they didn't have to take notes. They could sit back and relax and laugh all the way through the film. Even though this movie was projected inside the hallowed halls of the Smithsonian Institution, we were creating a fun film, not a dry, historical drama. The film became such a success that filmmakers like Keith Merrill who created the IMAX Theatre hit film, *Grand Canyon*, said that, "Without *To Fly!*, there may not have been an IMAX Theatre industry." I don't know if that is really true, but *To Fly!* certainly helped the industry grow.

How many theaters are there?» Today there are 235 IMAX-branded theaters using IMAX projectors, and about 100 additional

large format theaters utilizing other projectors. All the theatres are owned independently, by museums, cities, national governments, or private concerns.

How many IMAX features have you produced?» I have produced 29 large format films and directed 20.



What is your favorite?» Though I spend at least two years making each one of my films and therefore, have a deep affection for each, I think my mission-driven films, like *The Living Sea*, *Dolphins*, *Everest*, and *Coral Reef Adventure* are the most important to me. If

I had my wishes, I would make no other films except conservation-based movies. Also deep in my heart is *To Fly!*, because it was the last film that Jim and I worked on together. In every frame of that film, I see the artistry and perseverance that was Jim Freeman.

You've been particularly adept at matching your films to what seems to be the perfect music soundtracks. How did you get Sting to do the score for *The Living Sea*?» When I was envisioning *The Living Sea* back in 1991, I felt that it would be important with this film to enlarge its mission and attract a greater audience. I felt that to do so, I'd need better, more emotive music. So early on, I wrote down a list of five composers whose music I felt I could use in significant ways artistically in the film. We sent letters to these five composers and within a three-week period, Sting's manager called us back, asking for more information.

You have to understand that people like Sting or Stevie Wonder or Paul Simon make more money per year than nearly anyone and that each of these artists is very protective of his compositions and the way that these important songs are used. Though it helps enlarge their fan-base amongst our audience members, they get involved because they believe in our film's mission.

Sting and his wife Trudie Styler are ardent conservationists and are very concerned about communicating conservation messages to the public. Because *The Living Sea* was all about understanding and protecting the ocean, our film was a good match for them. The song *Fragile*, moreover, was the ideal theme song because of its tone, sensitivity and poetry. At the time that we were making this film, using pop music in an IMAX Theatre film was nearly unheard of and basing a soundtrack completely on one composer, someone such as Sting, had never been done before. I had a tremendous amount of

resistance from all kinds of people who were working on the film with me, and from theater managers who felt that a more traditional score, done by a Hollywood composer, would be more powerful and more significant. I didn't agree. I knew that we could take Sting's songs, such as *Fragile*, *One World* and *Why Should I Cry?* and make a very impactful soundtrack and film.

For one early test screening of *The Living Sea* in 35mm at our office, we inserted Sting's lyrical soundtrack in a very, very rough assembly. I gave our staff a questionnaire after the screening and asked them whether they felt that Sting's music added or subtracted from the movie. Only one person agreed with me that the film was far better with Sting's music. So even though there was a tremendous resistance and we were trying something completely new in our industry, I felt convinced that it was the right way to go and pushed hard with my staff to make it happen. With persistence and artistry, particularly from Steve Judson and Alec Lorimore, we were able to raise the bar a bit higher.

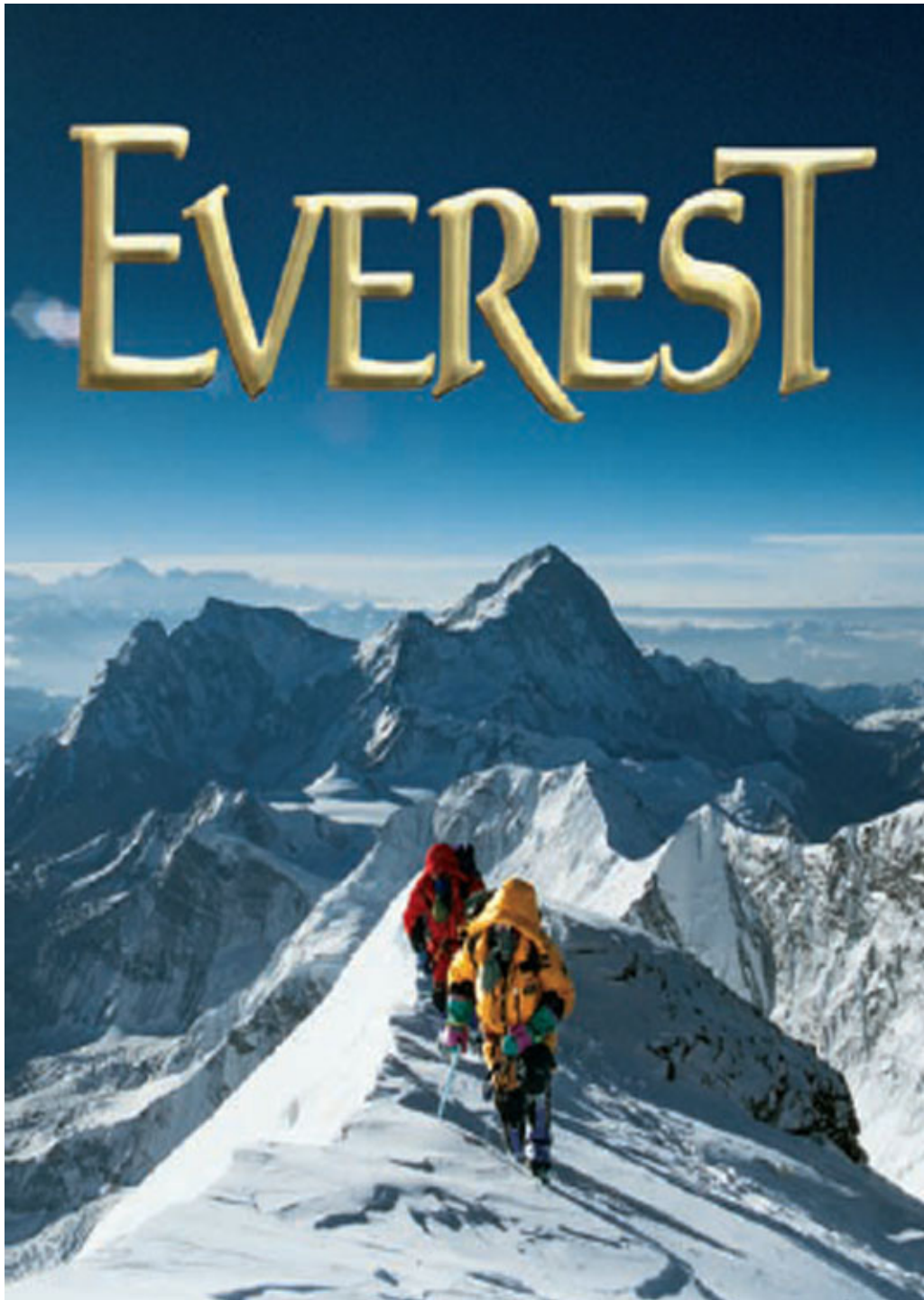
I felt that because each one of us has heard *Fragile*, *One World* and *Why Should I Cry?* at least a thousand times on the radio and at home, these pop standards hold memories for each one of us that, in most cases, are extremely positive and emotional. Some songs are so memorable that people can recall exactly where they were when they first heard them. I felt in making *The Living Sea* that if we could tap into those emotional memories that each audience member has that we would have a film that meant more personally to the audience than just a documentary with yet another orchestra score. Filmmakers like Steven Spielberg have never taken this direction in their film scoring. They choose instead, to use a completely fresh and original symphonic score, and in the case of Spielberg, from composers like John Williams. From my position, I felt that we would derive a more

emotional result by using melodies the audience had heard before. This was new ground for a documentary with a heavy narration component.

You continue in that vein with *Coral Reef Adventure* by incorporating the music of Crosby, Stills and Nash. How did you get them involved?» I knew that Crosby, Stills & Nash each have an affinity toward the ocean. Crosby and Nash are both surfers and sailors; Stills is a sailor and lives on an island. All three have a deep concern for the environment and for conservation of the ocean. I felt that their music, lifestyle and beliefs were completely in tune with *Coral Reef Adventure*.

I called David Crosby when he was on vacation in Hanalei, Hawaii, one of my favorite spots for surfing. He answered the phone at the house that he was renting on the beach, and I could hear a child playing in the background as we chatted. I told him about the film and he was enthusiastic about working on it with us, and then he had to interrupt and say, "You know, I promised my son who's now eight, that I'd take him out front and show him how to surf. So, I've gotta get going, but give me a call when I return to Santa Ynez and we can take this further." I thought at that point, boy, this guy's great. Not only is he talented, but also his priorities are right on.

The music by Crosby, Stills & Nash would do the same thing that Sting's music did for *The Living Sea* and that is, tap into the emotional well-spring of past memories for each member of the audience. Steve Judson, the editor and co-writer and I decided to use ten different songs from CS&N and base the score on those ten. Because each member of CS&N is a writer, instrumentalist, and vocalist, we also wanted to get the representation from each one of these enormous talents. I think their music lifts the film to a new level and will help



bring our message of conservation and sensitivity to the ocean's needs to far greater numbers of people around the world.

There is an element of “extreme” in virtually all of your work from the ocean depths to subterranean caves to soaring flight sequences and even the summit of Mt. Everest. How did a surf guy carve so broad a niche?» I think my films are broad in their subject base, going from a quiet, artistic documentary of *Dance of Life*, all the way to a brash and comical *To Fly!*, to a sensitive four-character climbing allegory in *Everest*, because surfing teaches you one thing – adaptability. You have to be adapting instantly to the conditions of the surf. I think because there are so many variables in surfing, a surfer has a much more fluid look at the world; things never seem rigid and confined, but expansive with all their possibilities. Every time a surfer looks out onto the ocean, the conditions are different; the wind is blowing one day, it is absolutely calm and glassy the next. One day the ocean is completely flat, no surf at all, and the next day the waves are thundering. Each wave a surfer rides is different by perhaps 50 percent from the wave that he just rode 10 minutes ago. With a mindset that conditions change instantly and that life's possibilities, whether they are themes for films or challenges to take on, are as wide, broad and diverse as the conditions of the surf, a person is ready for everything.

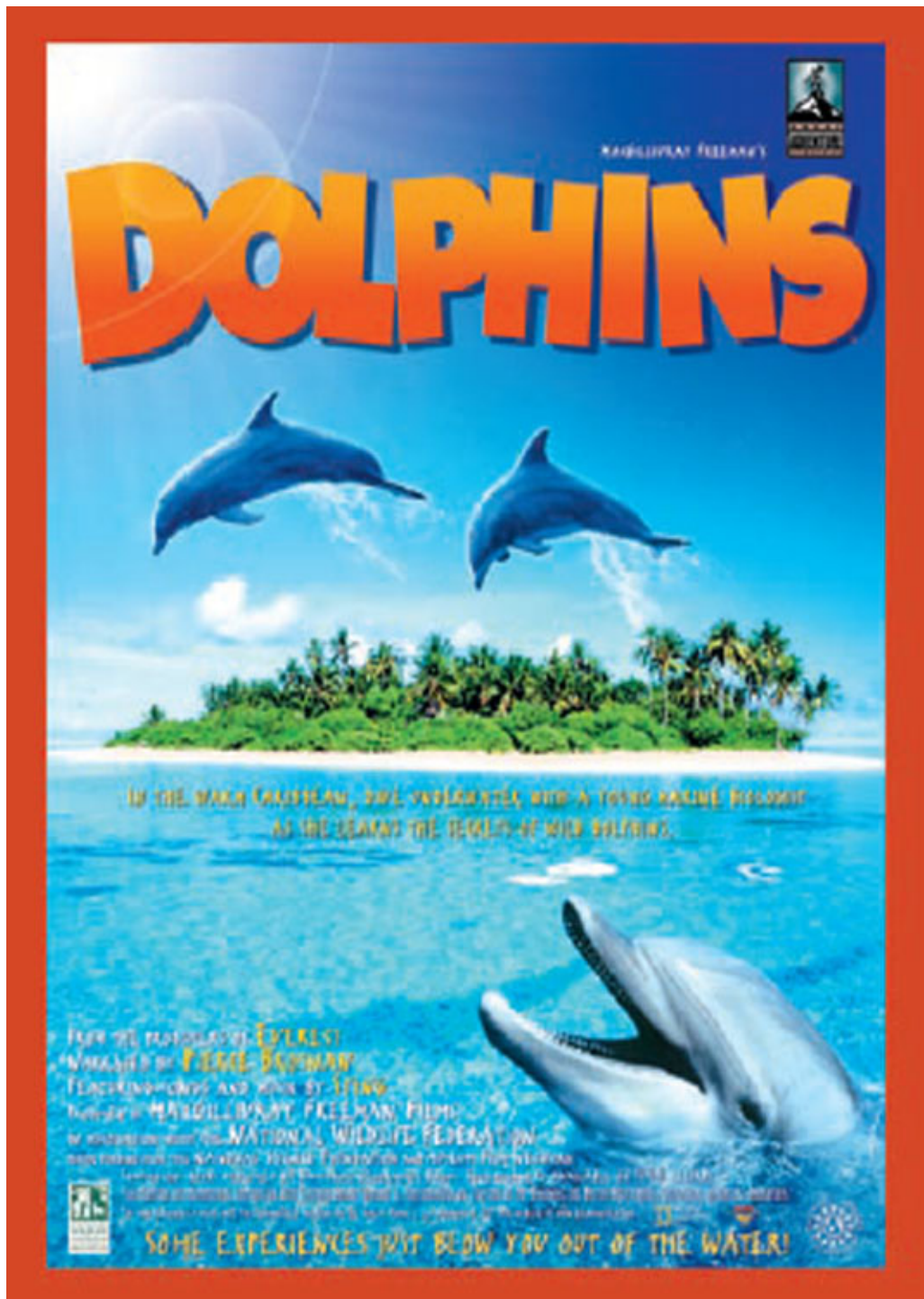
This is the way that I look at filmmaking. I never want to repeat myself. Like Stanley Kubrick, I'm most interested in working on new problems, not problems that I've solved in the past. This gives me an eagerness to take on the challenge of *Everest*, or the mission of communicating to the public the importance of coral reefs, or finding a way for a sky surfer to fall through the air with an 80-lb. IMAX camera strapped to his chest, when everyone has said it was impossible. It's my makeup to cherish the different, to relish the biggest and newest challenge. It's what keeps me alive.

Tell us about some of the challenges presented in getting an IMAX camera to the top of *Everest*, to nearly 400-ft. depths underwater, and hung on a stunt plane?» I approach every film I work on with fresh eyes, always looking for new ways to use the camera, new experiences for audiences, new stories to tell. So, in every film there are challenges that I can't wait to try to tackle. As a producer of the film, the toughest challenges are those where I feel a bit like a general sending my troops into battle. We hire the very best people to conduct specialty filmmaking, whether it's jumping out of airplanes with a camera strapped to your chest or sending a climbing team to the top of the tallest mountain in the world. Filming on Mt. Everest, of course, is fraught with danger, from killer altitudes to dangerous icy crevasses. Sadly the year we went was when so many died. Our film team became involved in the rescue efforts; it was just an awful, difficult time. We'd not yet tried to summit Everest with our camera when the tragedy on the mountain occurred. I did not want to push our crew to take the risk of going back up. They'd been through so much already. But they wanted to go. In their minds, there was no other choice. It was an agonizing few days for me as we waited to hear their progress. When our team called me via satellite telephone from the top of Everest, they sounded upbeat and very happy. I felt like I was on the top of the world! These films that we work on add to my list of personal heroes. Our film crews are very smart, courageous, hard-working individuals. I get a lot of strength and inspiration from them.

You forged a successful alliance with Howard and Michele Hall. How did you hook up with them originally and what other films have you collaborated on together?» I first came to know Howard and Michele from their reputation. For many years I'd been a fan of Stan Waterman, an underwater documentary filmmaker. I'd heard that Stan had said, "Well, there's a new man on the scene and I feel that he's the best underwater cinematographer in the world, and that

man is Howard Hall." I had either seen this quotation or heard it from Stan and I thought, boy, if I ever do an underwater film, I've gotta call this guy Howard Hall. At that time, I didn't even know where Howard Hall lived, and assumed that he was from the East Coast, where Stan Waterman resided. When we started to work on *The Living Sea*, I knew that I wanted to have some of the most beautiful underwater sequences that had ever been photographed for large format. So Alec Lorimore tracked down Howard Hall. Lo and behold, he lived in Del Mar, just 30 miles away, and was also a surfer. We got together and talked about the film, and Howard went with us to shoot the underwater sequences in Palau with Bob Cranston, Mark Thurlow and Brad Ohlund. We had that production divided up between my unit, which was the aerial and the ground unit and Howard Hall's unit, which was the underwater team. Each day after shooting, we'd get together at eight o'clock at night for a debriefing over dinner.

It was over those dinner meetings that I began to appreciate and deeply admire Howard Hall for his story telling ability, his humor, his humanity, and his ability to lead. Furthermore, he possesses one of the most important attributes, and a rare attribute once you've worked in Hollywood, that of honesty. He'll tell you his opinion directly and without spin, and he'll give you advice regardless of the consequences. Michele wasn't able to come on that trip with us because of our limited budget, but I got to know her very well and deeply respect her abilities after that trip. Somewhere around the latter part of the 1990s, I thought that it would be a good idea to make a movie about coral reefs and to have as the main characters, Howard and Michele Hall, a husband and wife team whose partnership is not only one of love, but one of mission. They're concerned about the oceans; they are dedicated to showing marine habitats and marine animal behaviors, and are true partners in adventure.



How did *Coral Reef Adventure* come to be?» In 1998, El Niño hit and almost 30 percent of the coral reefs in the world became bleached and many died. People concerned about the oceans were completely devastated by this news, including Howard, Michele, and I. I became determined to make a movie that would bring to the audience the news of these coral deaths and the work that had to be done to prevent future demise. It was at that time that I committed not only my resources but also the resources of my company to funding this conservation film, *Coral Reef Adventure*, and laid out the plan to photograph it over the next two-year period. At first, Howard and Michele were uncertain they should be on-camera in this film. They didn't want to be portrayed as heroes. It was my idea though that by looking at the reefs through their eyes and through their camera's lens, that the audience could not only see the love and concern that they share, but also see their dedication for saving the reefs of the world. After several months of persuasion, they agreed not only to photograph the film, but also to be, as you would say, reluctant stars of the movie. I think today, having gone through the experience with me that they feel completely comfortable with their role and are proud of the way that the film portrays them and their adventure across the South Pacific.

Why did you feel compelled to make an IMAX adventure film about coral reef systems?» The beauty of coral reefs is so unexpected and so spectacular, they're hard to resist. Diving among corals is like being in the middle of the greatest flower show ever – you're just floating in a blaze of color and your eyes are dazzled by shades of yellow and blue so brilliant it's hard to believe nature created them. Then, when you start to study the corals more deeply, more scientifically, and begin to understand how they make up this whole little village, this teeming community hidden from those of us who live up here on land, they really start to get fascinating. Once you learn that life in coral reefs is even more abundant than in the rain forest, you also realize just how important they are to the planet.

So it was my own love of coral reefs that inspired me, but it was also my alarm at reading scientific reports about the decline of the reefs. I felt that this was something the public should know more about right now, because I know that once you fall in love with coral reefs you can't imagine losing them. This film also has become part of my personal mission, which is to impart my deep passion for the ocean and to convey the importance of the sea and all its creatures to everyone in the world.

As a surfer, naturalist and filmmaker, you've spent a lot of time in the ocean. How have you seen coral reefs change?» In just 20 years of diving, I've seen tremendous, devastating changes. I can recall shooting a diving sequence in Indonesia 20 years ago in a coral reef that was just bursting with health and life and now has been severely damaged by over-fishing, dynamite fishing and a local population explosion that has had tremendous impact on the reefs. I'm not the only one who has witnessed the change. Anyone who has been diving for the last five years has probably seen it. Not only are the corals themselves being bleached and dying, but bio-diversity has been visibly reduced. That's why I think we really have a responsibility to learn more about the reefs scientifically so we can learn how to stop the damage and how to live in balance with them. I feel very strongly that there are workable solutions out there. Human beings are unique on this planet in being able to intellectually adapt to different situations and to solve problems. We just need to apply our scientific reasoning to the issues surrounding the survival of reefs. We can find smarter ways to fish and get rid of our wastes and live with the ocean in better harmony. But first we have to learn more about the reefs and their life systems.

What does the IMAX theatre image bring to underwater photography that you just can't get from regular film or video?»

An IMAX theatre film takes you there so you feel like you're under water with the divers. You can almost sense the pressure on your eardrums, and it's as if you're being cooled by the water. We've discovered that the IMAX image fools the brain so well that audiences watching our underwater movies actually experience a drop in body temperature – they literally cool off. That's part of the reason that we think films such as *The Living Sea* and *Dolphins* have been so popular. But it's more than refreshing – it's also awe-inspiring because it's a chance to really see and feel what the most expert divers see and feel, even if you don't know how to swim.

What's it like shooting an IMAX film underwater?» It's both a lot of fun and a tremendous challenge. When you're working with big cameras underwater, it's physically strenuous and you're always trying new things to balance yourself, to conserve air, to swim faster and that kind of challenge to your skills is always fun. Another wonderful aspect of shooting underwater is that you're always working in a team effort that leads to camaraderie and friendship that is unique and very emotional. For me, it's also a wonderful creative challenge – as I look for ways to meld innovative photography with dramatic, human storytelling to give audiences an experience they can't get anywhere else. But the flipside to this is that there is always danger, there is always an edge to working underwater. It's not just the critters – the sharks and the stingers and biters – that are going to get you. There are also things that can go wrong with gear or ocean currents that are out of your control. It's not an ordinary job but the rewards are so tremendous.

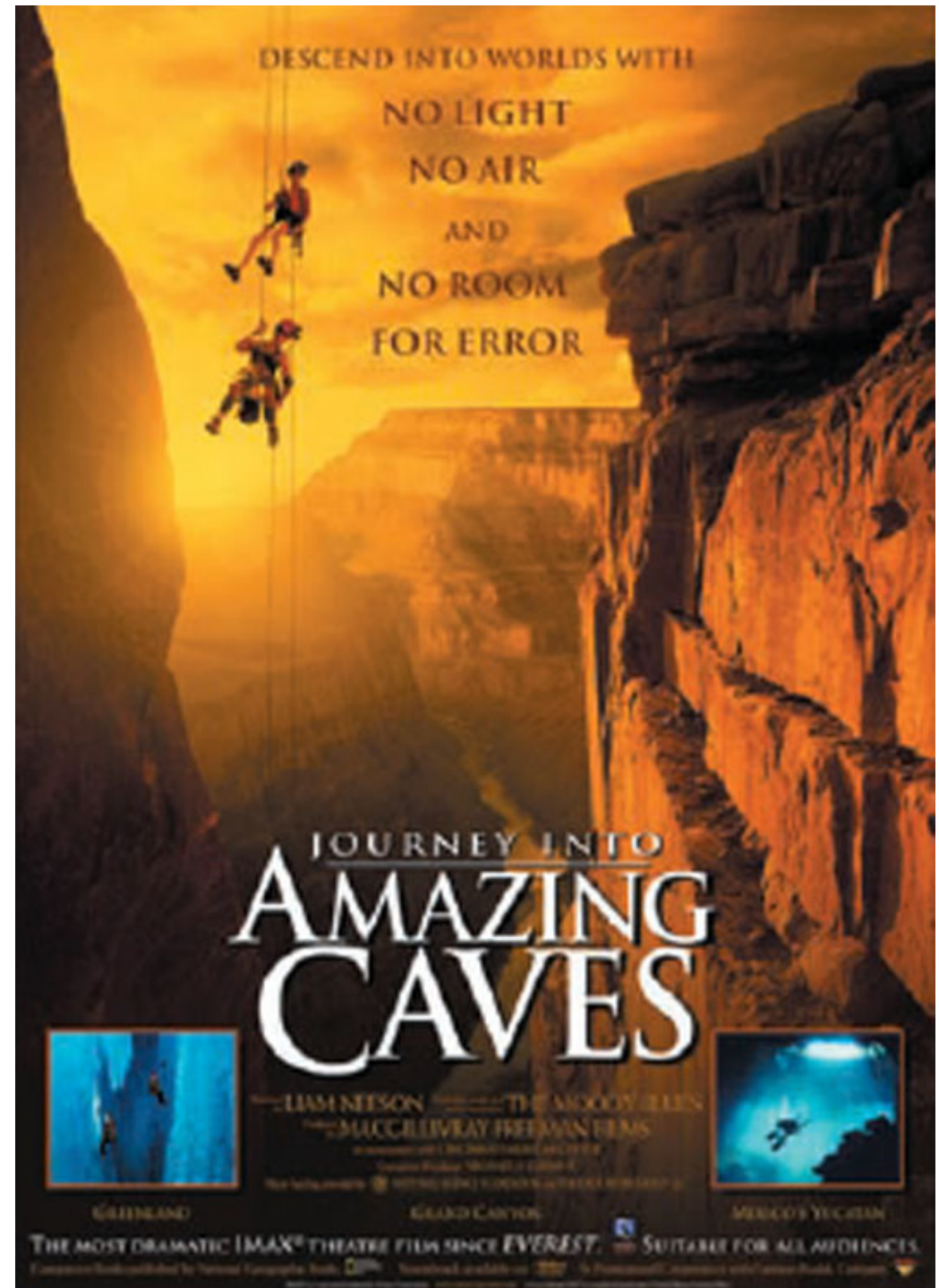
Were you ever scared that Howard Hall was taking too great a risk doing deep dives with the IMAX camera for this film?» I felt very similar to the way I felt when we sent out our teams to the top of Mt. Everest – a little bit like a general sending my troops into battle.

I knew the dangers were high and I also knew that the Halls wanted passionately to take the risks, but I still felt responsible.

It was especially hard for me when Howard got the bends. We had a month break after that, it was real soul-searching time for all of us as we questioned whether to continue, especially knowing that if Howard got the bends a second time it could be considerably worse, causing paralysis or even death. We had long talks about whether he really wanted to do it again and the answer was always the same: he felt very strongly that he must.

I had to trust Howard's instincts. He is such an intelligent, self-aware man and he convinced me he could dive back down to those severe depths with a reasonable amount of safety. I just insisted that they stay in close touch with me and gave them all the logistical support that I could. In the end, Howard and Michele have become two of my personal heroes. They really remind me of the kind of people who become astronauts – very courageous, charismatic and deeply caring, with a tremendous amount of knowledge, a great couple to travel around the world with.

Tell us about your favorite moment during the making of *Coral Reef Adventure*.» Even though I didn't do them myself, the deep dives were probably the most exciting part for me personally. Frankly, I'll never do that kind of diving myself. Going 350-feet down is for the most expert of the experts. And it is so technically demanding and the consequences are so severe, I won't do it. But watching our team do it time after time with so much courage and curiosity was really an inspiration. They have a deep understanding of the ocean and themselves, which is something I admire.



What is your personal vision of the future for coral reefs?» I'm an optimist. I have heard some scientists talk about doomsday theories of where the human population expansion is leading us, but it's my nature to believe we can figure out ways to limit our impact and solve some of the problems we are creating in the ocean. I look at it as a challenge that has been set before us – a big one, but one I think we are up to. One thing that excites me is that we are increasingly finding out more and more reasons why we must save the reefs. For example, pharmaceutical companies are discovering that there are very exciting medicinal cures among the plants and life forms of the reefs and they've only just scratched the surface of what's there. This is an incredible living resource – and I think that as our desire to keep the reefs healthy grows, we'll also find new ways to save them.

You're obviously comfortable with the ocean, and the sea has been a predominant theme in your films from the outset, but you came to scuba diving a bit late in your career. How so?» I became certified as a scuba diver in 1983 in preparation for an underwater sequence that I was going to shoot and direct in Indonesia for an IMAX Theatre film called, *Island Child*. My wife, Barbara, had researched and had written the story of seven individual children, boys and girls, from the age of infancy through to 18 years, each child growing up in a different culture and region on one of Indonesia's 3,000 islands. One of those stories, the final episode, was about a boy named Sandy who was studying to be a marine biologist at the university in Ambon. To photograph Sandy's story, we would travel over a three-week period aboard a dive boat all through the Java and Banda Seas. These seas have the most diversity of species of any location in the world.

We had a six-person crew: me as director and co-cinematographer; Ron Taylor as co-cinematographer; Valerie Taylor, who would be on-camera talent and still photographer; Ron and Valerie's nephew,

who would act as boat and equipment supervisor and would run the generator to power the underwater lights that I wanted to use; Brad Ohlund, who was the camera assistant; and Sandy, the on-camera talent.

We made two and three dives per day over a 21-day voyage and visited some of the most exquisitely beautiful coral reef locations anywhere in the world. We were able to shoot some of the most original underwater scenes yet to be done in the IMAX theatre format, and came away with an original sequence about this Indonesian student. The film was produced and shown for a five-year period at the Jakarta IMAX Theatre, the largest IMAX theatre in the world, which is located in a cultural park dedicated to communicating the importance of all of Indonesia's 50 or more cultures, languages, and histories. The film was a tremendous success, showing to almost a million people per year at that theater.

I was privileged to see the rough-cut of *Coral Reef Adventure* last June when you were testing its appeal with trial audiences. You've since reacted to input. What changes did you feel were necessary and why?» With *Coral Reef Adventure*, we did something that no other producer has done before. I decided that, because the issue of coral reef survival is so important to me and so important to many others, that we'd conduct almost a political campaign early, nearly nine months before the premiere of the film itself. We completed an early version of the movie and projected it in IMAX Theatres to more than 3,000 people in 10 locations in May and June 2002. The idea was to try to build support among all kinds of diverse elements: conservation groups, politicians, high school and college educators, civic leaders, corporate public relations departments who have an interest in conservation, and individual conservationists. Moreover, as a film artist, I would be able to show my film and get the audience's

response to the film so that I could make improvements to it before it premiered. This is much like trying out a play off-Broadway before it hits the big-time. From a creative standpoint, I learned a tremendous amount from the screenings and we were able to change quite a few elements in the film in order to improve our communication, the story's entertainment value, and to deliver better science and information. This effort is not one to be taken lightly though, because it is costly and it takes an enormous amount of time. In my opinion, it's worth this expenditure ten times over because of the additional impact that the film will have when it premieres on February 14th, Valentine's Day, as our tribute to the reefs in 2003.

What's next on your film agenda?» We're now finishing a film called, *Top Speed*, featuring Tim Allen and Marion Jones, which is a comedy for the IMAX Theatre market. We're beginning work on these films: *Greece – Secrets of the Past*, *Space Journey*, *Ocean Planet*, *The Nile*, *India*, and *Return to Everest*. All these films will take us out to about 2008. We've also just incorporated a not-for-profit side of our business to enable us to continue making educational conservation films, museum exhibits and books. It's called MacGillivray Freeman Films Educational Foundation.

What's your dream project?» I'm living it! I have the most talented, efficient and enjoyable staff in the whole world – and a great family – and they all make me very happy!

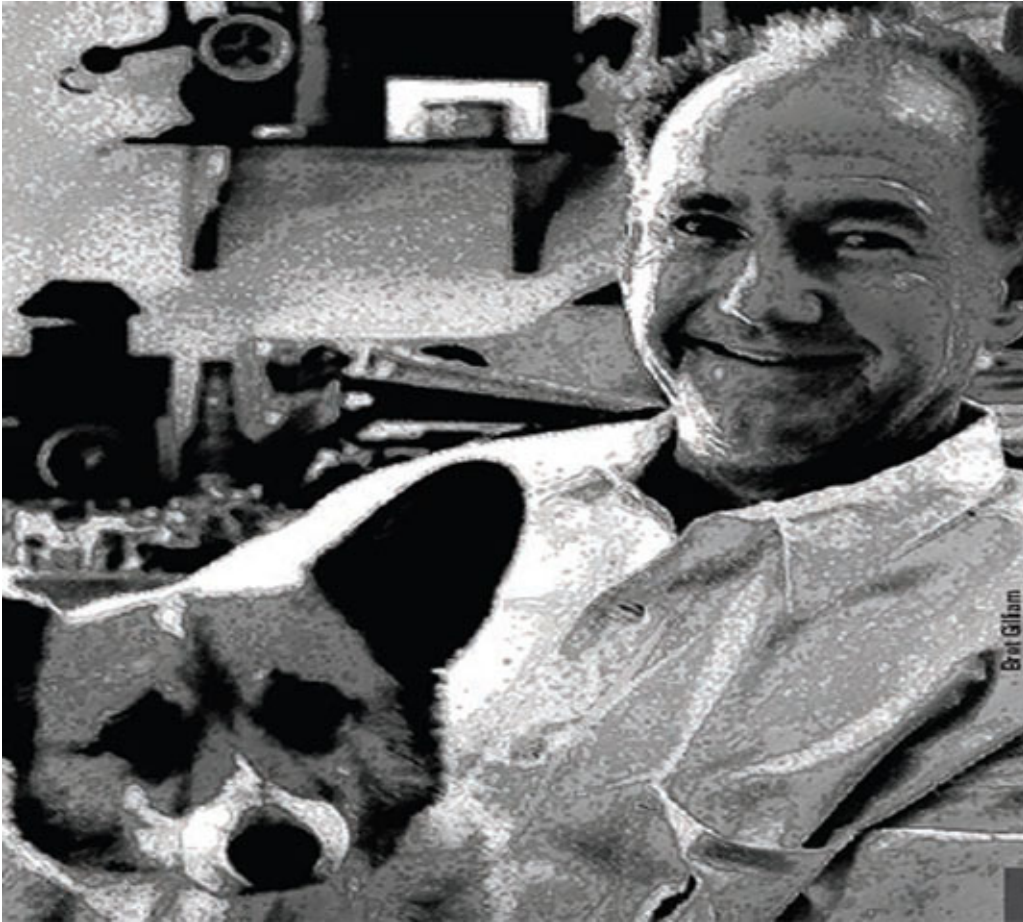
Finally, I know you still surf regularly. Where's your favorite spot and do the locals really know who the old guy is sharing the break?» I did a few smart things in my life. Number one, I followed my heart and became a filmmaker. Number two, I married my best friend, my wife Barbara. Three, I bought a house right at a surfing spot. This allows me even today to roll out of bed, walk to the

window, check the surf, and if it's good, paddle out and get a quick surf in even before work. Moreover, my idea of a perfect day is to go to work, make films for eight hours, come home at 5:00 and sit on my surfboard riding waves until 8:00 at night, with the beautiful sunset sinking beyond Catalina Island and my son, daughter and wife sitting on surfboards next to me, kinda feeling the rhythms of the waves, talking to each other about the comedy of life and about what film we would see that night after dinner. That's my idea of the perfect day.



It just so happens that the surfing spot where I live, called North Reef, is a very, very mellow and friendly spot. There are about ten surfers who frequent the place and each one of us gets along exceptionally well, which is the way I feel it is in Laguna and should be everywhere. Because I ride an 8-ft. long board, I'm looked at as a geezer in the water, but it doesn't really bother me because others who are there are there to laugh with me. In fact, many of the surfers who share the break with me also eat breakfast with me at our favorite, small, funky health food sandwich store, Orange Inn, which is about 100 yards away from the surf break. Even at the age of 57, I still try to stay as active as possible, probably surfing 60 to 80 days a year, and skiing, playing volleyball, Frisbee golf or mountain biking 40 to 60 days out of the year. You can't get locked to a desk or even an editing machine.

You have to keep moving both mentally and physically, keep pushing yourself in all kinds of different directions, taking off on waves of new styles and themes. I think that only in this way will you become original and creative in your artistry and enthusiastic about what you do.



Editor's note: There are about 40 copies of Diving Pioneers & Innovators still in Bret Gilliam's personal inventory. They are available as a Signed/Numbered Limited Edition personalized to each buyer by Gilliam at \$200 each, including shipping. He can be contacted for purchase at bretgilliam@gmail.com.

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