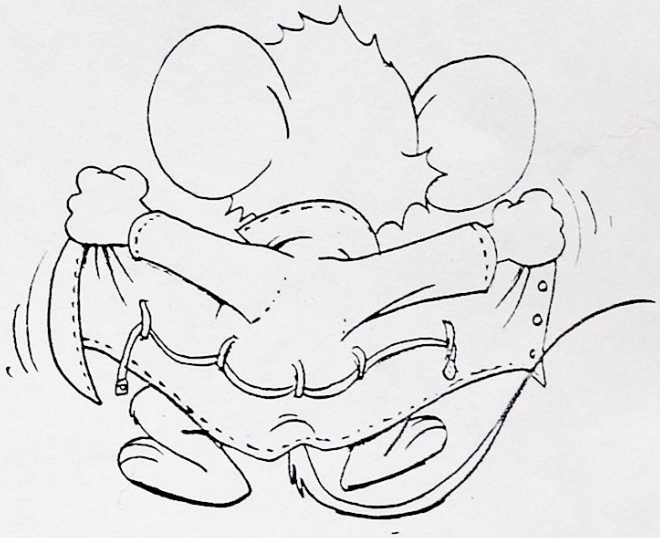
EXPOSING FIEVEL:

A REFERENCE HANDBOOK ON SETTING ANIMATION EXPOSURES
BASED ON EXPERIENCE IN THE MAKING OF AN AMERICAN TAIL.



October, 1986
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Russell Boland

THE PUZZLE

When we began setting exposures, filters, and gels on American Tail, we were endowed with volumes of dusty camera logs and drawers jammed with exposure sheets from former productions. They were overwhelming. They were also useless. Our cameras had been overhauled several times over, and there was no wise man who could recall anymore, for instance, what exactly F-8 had meant (100%? 200%??). As a result, we opted on Tail to include exposure percentage as well as F-stop information on each x-sheet. A pass entry will now read something like this:

1ST PASS 100% T.L. (F-5.6)

In this way, no matter how many times a week the technical wizards among us change our F-stops, the percentages on these sheets will always hold true for reference purposes.

During production, it is a good idea to photocopy the top portion of all x-sheets before sending them to camera. A file of these copies saves time in cross-referencing effects from scene to scene.

Stuffed somewhere between your reference files, old x-sheets, and granola-bar wrappers, this pamphlet should serve as a basic review of the exposure-setting process, including some of our trial-and-error experience in picking that one-in-a-million exposure that's going to knock their socks off in dailies (or at least not get you laughed out of dailies).

THE PIECES

Lenses.

We have two types of lenses for our cameras: 55mm and 105mm. We use the wider lens (55mm) for everything but multiplane scenes. (In the event that the 105mm is used, we have learned the hard way that f-stops should not be changed from pass to pass -- the lens will shift slightly, off-setting the registration of the passes. Instead, exposures should be changed using the shutter speed and/or neutral density filters.)

F-stops.

The F-stops (apperture sizes) on our camera are, from largest to smallest:

F-2.8 F-4 F-5.6 F-8 F-11 F-16 F-22 F-32

Each stop halves the exposure of the previous stop.

On American Tail single-plane scenes, 100% toplight was F-5.6. 100% backlight was F-11. Thus:

An American Tail Exposures (basis speed: 500)

	Toplight	Backlight
F-2.8	400%	1600%
F-4	200%	800%
F-5.6	100%	400%
F-8	50%	200%
F-11	25%	100%
F-16	12.5%	50%
F-22	6.25%	25%
F-32	3.125%	12.5%

Basis or Shutter Speeds.

Generally, we keep the basis speed (exposure time) at a constant (on Tail, the constant was 500, or half a second) and we utilize the F-stop ring to alter exposures. There are some cases, however, when it is desirable to use basis speed to effect exposures. When using the 105mm lens, for instance, we try to avoid changing F-stops. Also, in multiplane situations, a certain F-stop may be desired to control our depth of focus (the smaller the apperture, the greater the depth), so we may choose to alter the basis speed instead.

A doubling of the basis speed is equivalent to an opening of one stop. At longer speeds, there can be some variance from this correlation. For example, with our current multiplane set-up, the F-stops and basis speeds correlate as follows:

Multiplane Exposures (100%)
(for A-camera, with 4 optical glasses + 8 cels or N.D. compensation)

Toplight	Backlight	Basis Speed
F-2.8	F-5.6	250 (1/4sec)
F-4	F-8	500 (1/2sec)
F-5.6	F-11	1000 (1 sec)
F-8	F-16	2000 (2 sec)
F-11	F-22	4000 (4 sec)
F-16	F-32	13000 (13 sec)
F-22	-	45000 (45 sec)
F-32	-	120,000 (120 sec)

In virtually every single-plane scene, the basis speed is assumed as a constant and is often not even printed on the x-sheet.

N.D. Filters.

Neutral density filters are used at the lens to cut down exposures by more finely-tuned percentages than F-stops alone will allow. There are ten of these filters, numbered .10,.20,.30... .90,1.00. When the F-stop is set to 100%, they work as follows:

Filter	Cuts light down to:
None	100%
.10ND	80%
.20ND	63%
.30ND	50%
.40ND	40%
.50ND	32%
.60ND	25%
.70ND	20%
.80ND	15%
.90ND	13%
1.00ND	10%

On American Tail, for our single-plane set-up, this table was applicable:

EXPOSURE PERCENTAGES & F-STOP FIGURES FOR BACK LIGHT & TOP LIGHT

N.D.	TOPLIGHT F-STOPS						N.D.	BACKLIGHT F-STOPS					
	4	5.6	8	11	16	22		2.8	4	5.6	8	11	16	22
NO N.D.	200	100	50	25	12.5	6.25	NO N.D.	1600	800	400	200	100	50	25
.10N.D.	160	80	40	20	10	5	.10N.D.	1280	640	320	160	80	40	20
.20N.D.	126	63	31.5	15.75	7.88	3.94	.20N.D.	1008	504	252	126	63	31.5	15.75
.30N.D.	100	50	25	12.5	6.25	3.13	.30N.D.	800	400	200	100	50	25	12.5
.40N.D.	80	40	20	10	5	2.5	.40N.D.	640	320	160	80	40	20	10
.50N.D.	64	32	16	8	4	2	.50N.D.	512	256	128	64	32	16	8
.60N.D.	50	25	12.5	6.25	3.13	1.56	.60N.D.	400	200	100	50	25	12.5	6.25
.70N.D.	40	20	10	5	2.5	1.25	.70N.D.	320	160	80	40	20	10	5
.80N.D.	30	15	7.5	3.75	1.88	.94	.80N.D.	240	120	60	30	15	7.5	3.75
.90N.D.	26	13	6.5	3.25	1.63	.81	.90N.D.	208	104	52	26	13	6.25	3.25
1.00N.D.	20	10	5	2.5	1.25	.63	1.00N.D.	160	80	40	20	10	5	2.5

Diffusion Filters.

Diffusion filters are used at the lens to soften the exposed image (used most often with backlit effects and some toplit efx, such as smoke, wind, and water drops). There are eight of these, numbered D1 through D8, from least to greatest diffusion.

When diffusion filters are employed, an exposure compensation may be necessary. I figure (this has not been tested) that a D2 cuts down the exposure by about 10%. A D4 therefore would require a compensation of 20%, and so on. These are approximations. Since the diffusion filters were hand-made, it is probably not possible to determine a hard-and-fast rule on compensating exposure loss, but it is important to keep this in mind when figuring exposures.

Gels.

We have used colored gels in two ways:

1) At the lens.

Dorse has custom-made several gel filters to be carried at the lens. These serve to subtly tint an efx element. For the most part, we've used these to better marry our live-action efx stats to the scenes in which they are used. (E.g. Live-action smoke generally used a BAF (bastard amber filter) at lens; live-action rain generally called for a LB (light blue) filter at lens, depending on the overall hue of the scene).

2)On the artwork.

This is for backlit efx only. Nearly all B.L. efx utilize a colored gel. Fire always uses a yellow gel (Y.G.), lightning and electricity a blue gel, embers an orange gel, explosions, highlights, spotlights, glows can use any of the spectrum. Here is a list of the gels kept at the camera department during American Tail:

16 FIELD GELS

1. 807+806, DY	Dark Yellow
2. YG	Medium Yellow
3. OG	Orange
4. LO	Light Orange
5. O-21	Orange with blue on top half
6. 818, R	Red
7. RG1	Vermillion
8. OG	Light red
9. 821, Drk Rd	Dark Red
10. CP	Cool Pink
11. MG	Magenta
12. PRP	Pale Rose Pink
13. LM	Light Magenta
14. 838, VM	Violet Magenta
15. PG1	Violet
16. 846, PURPLE	Purple
17. 857, Drk Blu	Dark Blue
18. MB1	Medium Blue
19. MB2	Railroad Blue
20. LB, Lt Blu	Light Blue
21. GB1	Light Gray Blue
22. GB2	Blue Gray
23. SB	Sea Blue
24. PB-73	Peacock Blue
25. 877, BLU-GR	Blue Green
26. GR	Green
27. 871, LG	Light Green
28. 878, EG1	Emerald Green
29. EG2	Emerald Green
30. BST	Bastard Amber

Ripple glasses.

There are three basic ripple glasses that are run just under the lens to create the illusion of water ripples or looking through glass (e.g. the bottle Fievel's in).

RG1	Light Ripple
RG2	Medium Ripple
RG3	Heavy-duty Ripple

Additionally, there is

RG4	Coarse shower-glass Ripple

Several experimental glasses have been made for specific purposes, including two labeled A and B that are speckled, used to create a moon shimmer (never used).

A special medium-grade ripple glass has been made for multiplane purposes, to be carried just under plane-2.

Ripple glasses cut down the light by a few percentage points and add considerable diffusion to the image (additional diffusion filters are never necessary).

Star filters.

There is a 4-point and an 8-point star filter. We traditionally use a 4-pointer. This will be employed only on very short sparkles or flashes and needs a considerable amount of backlight intensity to be effective.

Other filters.

You can shove anything in a filter holder and call it a filter. One that was created for the reunion sequence in American Tail diffused only the outer edges of the frame.

PUTTING IT ALL TOGETHER

The best possible combination of exposures for a scene will not draw attention to any one of its parts, but will work together as a whole to create a believable and appealing atmosphere. Although exposure-setting tends to be an invisible part of the production process, it is the key step in bringing together the mass of artwork that has been prepared, and shaping it on screen into the final image with which audiences will be left. When the pieces all fit together right, the audience doesn't just see an assortment of artwork jumbled on the screen -- the celluloid world will take on a life of its own, and that's when animation is its most magical.

Enough poetry.

Before setting any exposures on a scene, flip through the artwork, make a cel set-up over the background, and familiarize yourself generally with the nature of the scene. Determine all the efx that are going on in it before setting exposures on any of them. It is best to have a total vision in your head of how the scene should look on screen before moving in with the numbers. Pay attention to contrast. The same effect may require different exposures in different scenes. Transferrring numbers from another x-sheet may therefore be a mistake (of unthinkable proportions).

There are three ways of layering elements onto the film: splits, toplit DX's, and backlit burn-ins. Here we go:

Split Exposures.

This refers to adding two or more exposure passes together to equal 100% (as a general rule). Use a split when you want one or more elements in the scene to be transparent or transluscent. Most commonly, this is used for shadows which are painted opaque black. Shadows are almost invariably split 63/40 (an even 60% is not on the exposure chart menu). This means the background, character levels, and shadows are exposed for the length of the scene at 63%. The shutter is then capped, the film is rewound to the start of the scene, and the scene is shot again -- this time without the shadows -- at 40%. The final image exposed on the film will therefore depict the shadows at a transparent 63% and everything else at a full 103%. (The additional makes virtually no difference from the other scenes shot at 100%.)

There is no science to setting the percentages of split exposures. Even shadows will sometimes need to be darker or lighter than the normal 63%. We had one such instance with a murky background, on which a 63% shadow obliterated into the vast depths and darkest reaches of oblivion anything beneath it. It had to be lightened.

Contrast is an important factor. As a general rule, the lighter (value-wise) an element is, the hotter it looks (percentage-wise) on screen. Therefore, on a particularly light background, a split element may need to be exposed greater than the norm to achieve the same effect. Likewise, an exceptionally light element may need less exposure to appear "right." Conversely, on a dark background, the split element may require a lesser percentage to read well, while a dark element may need to be exposed above par to read the same as something lighter.

There are numerous examples of splits, sometimes even three-way splits (e.g. to put Fievel in a bottle that has both a front and a back). We even split an entire sequence, with a D2 on one of the passes, to add up to more than 100% for a pastel, atmospheric effect.

Here is a limited listing of some very general exposure guidelines on different types of effects, compiled from the American Tail records:

Effect	Average Split
Shadows	63/40
Water	63/40
Smoke	80/20
Reflections	50/50
Glass	20/80
Bubbles	20/80
Kerosene	40/63

These should serve as a jumping off point, but should not be taken for gospel. Water effects, for instance, can range the full gamut, from 20% to 100%, depending on color, contrast, and desired thin-or-thickness.

Toplit DX's.

Double exposures are different from split exposures in that the DXed elements are "burned" into the film at a total of more than 100%. Therefore, the scene is shot first over the background at 100%. Shutter is capped, film is rewound, and the DX element is then exposed over black on top of the 100% image already on the film. Anything darker in value than the image already on the film will simply not expose. Thus, the black that surrounds the efx element being shot will not alter the image already on the film in those areas.

A big fat hairy rule of DXing is:

YOU CANNOT DX DARK OVER LIGHT.

It will not work. Be sure the DX element is lighter than the other animation and background shot in the first pass. Otherwise, it must be split.

Toplit Dx passes generally do not exceed 100% exposure (remember that a 100% DX actually means the film has been exposed to 200% in the DXed areas). Many DXed efx require diffusion and sometimes gel filters at the lens (particularly live-action efx). As with splits, it is

essential to look at the contrast of the elements with the background to determine a proper exposure in each case. It may vary from scene to scene.

As a special note, some smoke is planned as a combination split/DX. One level of smoke will be split at 80/20 and another will be DXed over that at 100% with a D4.

Here are some averages compiled from our American Tail archives:

Effect	Average DX
Live-action Rain Stats	80% + LB Filter at lens
Live-action Smoke Stats	32% or 40% + BA Filter at lens
Animated Smoke	80% + D3 or 100% + D4
Water Drops/Tears	80% + D2
Cobwebs	20% or 32% + D2
Bottle Highlights	20% + D3
Airbrush Fog	80% or 100% + D2
Dry-brush Wind	32% + D4

Backlit burn-ins.

Like toplit DX's, backlit efx add to an already exposed 100% image. They are prepared as black exeter mattes that allow light through to expose the film only in the area of the effect. Sometimes "master" or "garbage" mattes are used for a length of footage to mask out the parts of the frame that the animation never enters, and the animating mattes fit inside this element. Additionally, when characters are to pass in front of the backlit effect, the regular character cels are opaqued with gray back-paint and called for as self-mattes. This means, they are carried where necessary during the backlit pass to block the light where the characters are already exposed on the film. The need for self-mattes is sometimes overlooked, so be on guard.

Backlit efx can range from our lowest possible intensity (2.5%) to our very hottest (1600%) depending on the effect. A spotlight, for example, should be at the very low end of the exposure spectrum with mega-diffusion (D4 or D6), while the sparkle of a coin may require 1600% with a star filter. (Regarding star filters, the great guru Dorse once spoke, "I've never seen a star filter with too much light." In order to achieve maximum starring, the more light the merrier.)

Very commonly, diffusion filters and gels on the artwork are utilized. Both of these additions effect how much light gets through to the negative. A darker gel obviously cuts out more light than does a lighter, so the percentage backlight called for should be adjusted accordingly. With diffusion, as previously mentioned, I estimate a D2 cuts out about 10%. I would figure about the same for a light-colored gel (e.g. yellow) and double or triple that for a dark one.

SIZE of the backlit area is a major consideration in determining exposures. If the entire frame were illuminated at a given percentage, the light would appear brighter on the film than it would if the same percentage backlight were shone through a small hole. Even minute differences in hole size can account for notable changes in exposure intensity.

THE LARGER THE BACKLIT AREA, THE LOWER THE PERCENTAGE REQUIRED TO ACHIEVE THE SAME EFFECTIVE INTENSITY.

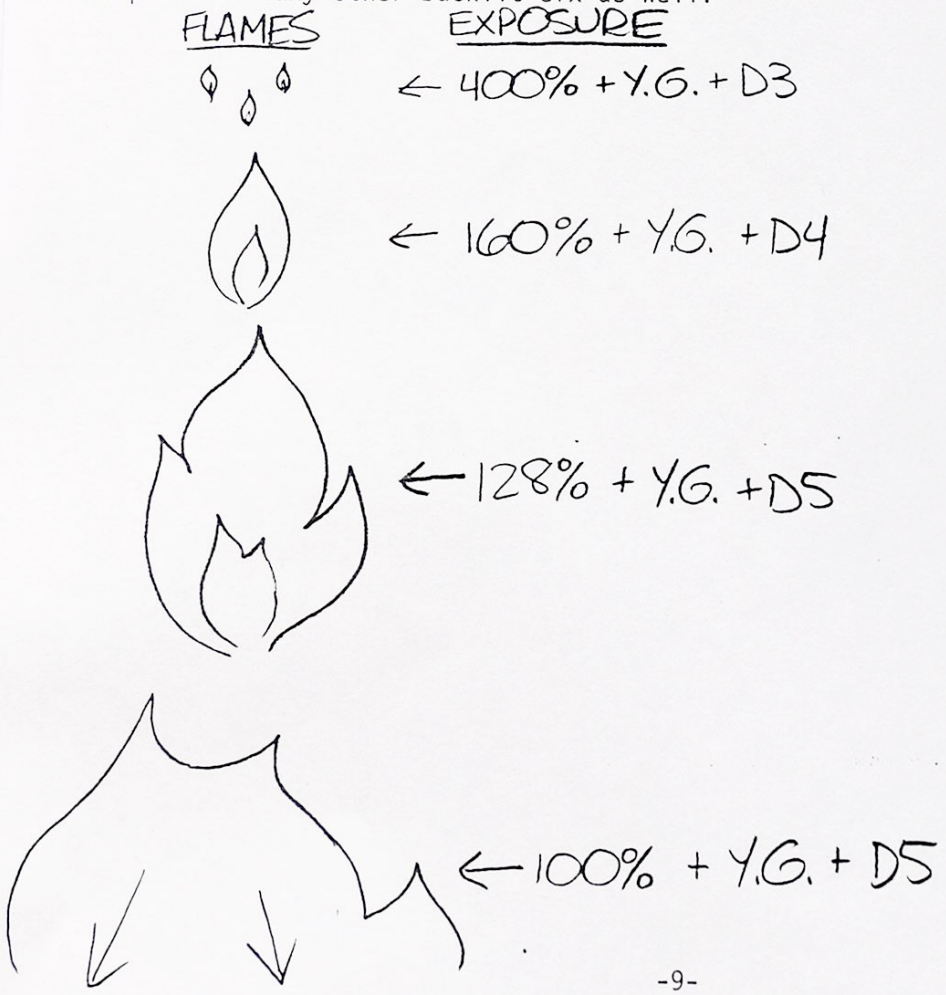
A small flame will therefore need more exposure than a large one to appear as bright.

Size also effects the hardness/softness of the shape that contains the light. A pinhole diffuses the light passing through quite a bit, while a larger area has fairly defined edges.

THE LARGER THE BACKLIT AREA, THE LESS APPARENT DIFFUSION THERE WILL BE.

Thus, to diffuse a small flame and a large flame the same, the former will require a lower diffusion filter than the latter.

During American Tail, I drew the following "flame-chart" that proved helpful for many other backlit efx as well:



In the case of a slotgag/actuator set-up, or a similar situation in which there are many small areas that together define a large backlit region, plan exposure percentages and diffusion filters as if you were doing so for the single larger area the small sections encompass. For example, the slotgag ripples on an ocean that might occupy half the frame should be exposed at the low percentage you would a half-frame opening.

In some instances, there are backlit passes that overlap or add to each other. Electricity efx, lightning, fireworks, and sometimes fire, will have a "core" pass that burns out the center of the effect, leaving a diffused, colored outer area. Use considerable diffusion on the pass creating the larger area, and low diffusion on the core pass.

The following are some average backlit exposures on American Tail:

Effect	Average Backlight Exposure
Fire	See previous page
Embers	320% + OG + D3
B.L. Snowflakes	128% + BA Filter at lens
Character Rim Hilites	50% + D4 + gel (YG or OG or RG)
Glass or Metal Hilites	200% + D2 + gel (to match)
Cigar glow	63% + D5 + RG
Digit's Electrode	1st Pass - 400% + D2 + G2 2nd Pass - 1600% + D4 + G1
Train Sparks	400% + D4 + MB2
Glow around flame	40% + D8 + YG
Spotlight	3.75% + D4 or D6 + YG
Full frame flash	100% + gel
Star Sparkles	1600% + star filter
Fireworks	320% or 400% + D3 + gel
Bubble Hilites	100% + D4 + gel /or 50% + D7 + no gel

Range Tests.

"Range" or "wedge" tests are necessary when you find yourself staring at something you've never seen anything quite like before in your life. On such stumped occasion, request camera to shoot a particular set-up from the scene for 2-00 intervals at different exposure combinations. Usually five or six possibilities are enough to cover the range of your uncertainty. You hope that one of those tests will look "right on".

If there is any uncertainty in planning the exposures for a scene, it is advisable to send for a range test (which do not take that long to shoot) rather than shoot the entire scene and have to shoot it again and again before getting it right.

Our man Russell has designed a handy form for ordering such tests.

Exposure Sheet Notation.

The x-sheet has traditionally left a foot at the top, above the start mark, to indicate pass information. To the right of the animation columns, write the pass number, whether it's toplight (T.L.), backlight (B.L.), or DX over black, the percentage and corresponding F-stop/ND info, and any filters or gels required. On the same horizontal line, check off which of the animation level columns should be exposed on that pass. An "X" in one of those columns means to carry a blank instead of the animation for that particular pass.

Here's a sample:

	DIAL	EXTRA	4	3	2	1	EXTRA	CAMERA INSTRUCTIONS
		✓	X		✓	✓	✓	1ST PASS 20% T.L. OVER BG (F-5.6+.70ND)
		✓	✓		✓	X	✓	2ND PASS 50% T.L. OVER BG (F-5.6+.30ND)
		✓	✓	✓	✓	X	✓	3RD PASS 32% T.L. OVER BG (F-5.6+.50ND)
✓	✓						(F-5.6+.70ND)	4TH PASS 20% DX + DIFF D3
								5TH PASS 200% T.L. + L.G. GEL (F-8)
								6TH PASS 32% DX · Y.F.L. (F-5.6+.50ND) YELLOW AT LENS FILTER (16FPS)
T.L.	DX	32%ND						
BOTTLE	BOTTLE	WATER -	WATER IN	BOTTLE		BOTTLE		PAN BG ON T.P. RT 4
HILITES	HILITE	REFLECTION	BOTTLE	FRONT	FLEVEL	BACKSIDE	BG	POS (C) 5000
								T.P.

Optical Composites & Bi-pack Exposures.

We have employed two methods of combining different strips of film onto a single composite strip. (This is used most often when a background must recede or near while the character remains at a constant distance.)

1) Lab opticals.

Fred Craig has a handout explaining what is commonly referred to as the 3-strip process (although 3 is not always an accurate number). Basically, a separate strip must be shot for A) the background 100%T.L., B) the characters et al 100%T.L. over black, C) the characters et al self-matted at 100%B.L. (master mattes), and D) each DX or B.L. effect on a separate strip at 100%T.L. or 100%B.L. respectively. In an optical printer, these strips are compos-ted onto the final strip of film.

As far as exposures are concerned, all strips must be shot at 100% with no diffusion and no colored gels. These effects are accomplished later in the optical printing of the composite strip.

Here are examples of optical x-sheet notation and the accompanying instruction slate to the lab:

RA	4	3	2	1	EXTRA	CAMERA INSTRUCTIONS
					✓	STRIP A 100% TOPLITE
	✓	✓	✓	✓		STRIP B - 100% TOPLITE
	✓	✓	✓	✓		STRIP C - 100% BACKLITE

FILM STOCK	OPTICAL INSTRUCTION SLATE
5247	STRIP A: BACKGROUND ELEMENT
	OPTICAL: MATTE FOREGROUND ELEMENT OVER THIS
5247	STRIP B: FOREGROUND ELEMENT
	OPTICAL: MATTE THIS ELEMENT OVER BG
5369	STRIP C: BURN-IN MASTER MATTE
	OPTICAL: MAKE PRINT-BACK HOLDOUT MATTE FROM THIS ELEMENT

2) L.C.P. Bi-packs.

This process uses the animation stand instead of the optical printer to composite the final strip. Fred Craig devised this process to more easily accomodate scenes requiring mult-ple exposures, diffusions, and gels. Put simply, the background is shot first 100%T.L. and a low contrast print of it is then bi-packed in the camera with raw stock. Using 100%B.L., the characters et al are self-matted onto the new negative, exposing the background only where they're not. The background strip is then removed and the characters are shot 100%T.L. over black, or as a split exposure (for shadows or the like) adding up to 100%. Subsequent DX or B.L. passes are then exposed with the same percentages, filters, and gels they would normally use.

Here's a sample formatting of the pass information on an LCP bi-pack:

DIAL	EXTRA	4	3	2	1	EXTRA	CAMERA INSTRUCTIONS
		(TRUCK & CAMERA SHAKE)				✓	• BG STRIP- SHOOT ON 5247 STOCK AT 100% T.L. (F-5.6)
							TO DEVELOP - ORDER 5380 LCP (LOW CONTRAST PRINT)
							BI-PACK LCP PRINT WITH 5247 RAW STOCK
							COMPOSITE STRIP =
			✓	✓	✓		• 1ST PASS 100% BACKLIGHT
							TO CONTACT-PRINT BG STRIP ONTO RAW STOCK, WITH ANIMATION SELF-MATTE
							→ (REMOVE LCP) ←
			✓	✓	✓		• 2ND PASS 100% T.L. OVER BLACK
		✓					• 3RD PASS 80 % DX+D4
	✓		✓				• 4TH PASS 200% B.L.+D3+O.G.
	✓						• 5TH PASS 160% B.L.+D3+Y.G.
✓			✓				• 6TH PASS 252% B.L.+D4+R.G.
			✓				• 7TH PASS 252% B.L.+D2+R.G.

Multiplane Exposures.

In the LENSES section, I've already mentioned the switch to a 105mm lens for multiplane set-ups and the inherent problems thereof. Also refer to the BASIS SPEED section for our current multiplane exposure table. Because of the added variable of altering basis speeds and the general complexity of the multiplane set-up, it is an excellent idea to conduct extensive range tests. There are no short-cuts here, as we've learned. Aside from effecting depth of focus, different basis speeds can also effect the hue of the scene -- something to watch out for in tight continuity situations.

The multiplane x-sheet currently calls for toplight illumination as follows:

Plane 1: 130 volts, 100 footcandles
Plane 2: 120 volts, 75 footcandles
Plane 3: not yet determined

This illumination assumes 2 pieces of optical glass and 4 cel levels for each of planes 2 and 3, or a total of 4 glasses and 8 cels. When these are not all present, we use ND filters to compensate for missing levels and glasses. Some equations to remember:

1 CEL = .03ND
1 OPTICAL GLASS = .015ND

So, for an example, if there is no plane 3 and only 2 levels of animation exposed on plane 2 (along with 2 optical glasses), we need to add the equivalent of 6 cels + 2 optical glasses, or .18ND + .03ND, the sum of which is .21ND. We round that to the closest ND filter we have, which is a .20ND, and call for that to be affixed to the lens for the entire scene.

Multiplanes grant us an additional exposure variable of focusing on one level or another, or somewhere in between, to create depth and atmosphere. Focus can also be used instead of diffusion filters on DX passes.

THE MISSING PIECE

A final note: All specific information in this pamphlet regarding illumination, F-stops, basis speeds,and the like, are subject to change when our cameras are reassembled for the next picture. The procedural information, however, as well as the percentage guidelines listed within, should remain helpful as long as we're turning out animated pictures. For lack of a brilliant last line, I'll use one of Fitzgeralds:

"And so we beat on, boats against the tide, drawn back ceaselessly into the past."

NORTH / SOUTH AXIS CONVERSIONS FOR ACME CAMERA

CAMERA POV - NORTH			CAMERA POV - SOUTH		
FLD	STD #	ACM #	FLD	STD #	ACM #
12	54320		12	45620	
11	53960		11	46040	
10	53600	1000	10	46400	00
09	53240	950	09	46760	50
08	52880	900	08	47120	100
07	52520	850	07	47480	150
06	52160	800	06	47840	200
05	51800	750	05	48200	250
04	51440	700	04	48560	300
03	51080	650	03	48920	350
02	50720	600	02	49280	400
01	50360	550	01	49640	450
00	50000	500	00	50000	500

1 FLD = 50 Increments

3/4 FLD = 37.5 Increments

1/2 FLD = 25 Increments

1/4 FLD = 12.5 Increments

EAST / WEST AXIS CONVERSION NUMBERS FOR ACME CAMERA

CAMERA POV - EAST			CAMERA POV - WEST		
FLD	STD #	ACME #	FLD	STD #	ACME #
12	56000		12	44000	
11	55500		11	44500	
10	55000	00	10	45000	1000
09	54500	50	09	45500	950
08	54000	100	08	46000	900
07	53500	150	07	46500	850
06	53000	200	06	47000	800
05	52500	250	05	47500	750
04	52000	300	06	48000	700
03	51500	350	05	48500	650
02	51000	400	02	49000	600
01	50500	450	01	49500	550
00	50000	500	00	50000	500

1 FLD = 50 Increments

3/4 FLD = 37.5 Increments

1/2 FLD = 25 Increments

1/4 FLD = 12.5 Increments

ACME VERTICAL INCREMENTS / FIELD SIZES

FIELD	VERT	+1/4FLD	+1/2FLD	+3/4FLD	
22	9120	----	----	----	480 INCR PER FULL FLD
21	8640	8760	8880	9000	120 INCR PER 1/4 FLD
20	8160	8280	8400	8520	240 INCR PER 1/2 FLD
19	7680	7800	7920	8040	360 INCR PER 3/4 FLD
18	7200	7320	7440	7560	
17	6720	6840	6960	7080	
16	6240	6360	6480	6600	
15	5760	5880	6000	6120	
14	5280	5400	5520	5640	
13	4800	4920	5040	5160	
12	4320	4440	4560	4680	
11	3840	3960	4080	4200	
10	3360	3480	3600	3720	
9	2880	3000	3120	3240	
8	2400	2520	2640	2760	
7	1920	2040	2160	2280	
6	1440	1560	1680	1800	
5	960	1080	1200	1320	
4	480	600	720	840	
3	0	120	240	360	

ACME ROTATION POSITIONS

CLOCKWISE			COUNTERCLOCKWISE		
POSI. IN DEG.	STD #	ACME #	POSI. IN DEG.	STD #	ACME #
90	41000	5900	90	59000	4100
85	41500	5850	85	58500	4150
80	42000	5800	80	58000	4100
75	42500	5750	75	57500	4250
70	43000	5700	70	57000	4300
65	43500	5650	65	56500	4350
60	44000	5600	60	56000	4400
55	44500	5550	55	55500	4450
50	45000	5500	50	55000	4500
45	45500	5450	45	54500	4550
40	46000	5400	40	54000	4600
35	46500	5350	35	53500	4650
30	47000	5300	30	53000	4700
25	47500	5250	25	52500	4750
20	48000	5200	20	52000	4800
15	48500	5150	15	51500	4850
10	49000	5100	10	51000	4900
5	49500	5050	5	50500	4950
0	50000	5000	0	50000	5000

READY-FOR-CAMERA CHECKLIST

Prod. ____ Seq. ____ Sc. ____

- ☐ FOOTAGE CHECK - Footage on X-sheet folder matches footage exposed matches footage called for in Blue-Book, Storyboard, Greys.
- ☐ BLUE-BOOK CHECK - Check that camera fielding, movement, or special requirements (overlay moving faster) have been exposed on X-sheet.
- ☐ SWEATBOX NOTE CHECK - Make sure all notes have been taken care of.
- ☐ X-SHEET COLUMNS LABELED - All animation and camera columns properly labeled above column.
- ☐ LEVEL CHECK - All levels called for in X-sheet must be in scene.
- ☐ LEVEL COUNT - If more than 5 paper levels will be needed, some non-animating levels must be traced onto cels.
- ☐ BLUE SKETCH B.G. - Must be included in scene and on X-sheet.
- ☐ "FINAL LAYOUT DUPE" - Get Original Layout, check that blue sketch matches, and stamp blue sketch in corner.
- ☐ OVERLAYS, UNDERLAYS - If made, be sure to include dupe in scene, stamped as well.
- ☐ PATH OF ACTION - Rub down area on blue sketch where animation takes place.
- ☐ DRAWING COUNT - Every drawing number called for on X-sheet (in graphite pencil) must be in scene.
- ☐ REINFORCEMENTS - All drawings must be reinforced.
- ☐ DRAWINGS LABELED - With sequence, scene, drawing numbers in proper format.
- ☐ PEGHOLES LABELED - According to Final Layout, on both panning animation and blue sketches.
- ☐ WHICH PEGHOLE AT SCOOO - (Paris only) Labeled above pan column in X-sheet.
- ☐ CAMERA FIELDING BOX - In square above camera columns.
- ☐ COMPUTER CODING - In Special Instructions area atop X-sheet.
- ☐ TOP PEGS, BOTTOM PEGS - Make sure artwork will work as punched. Beware flip pegs, N-S pegs. Ask if confused.
- ☐ NEATLY PACKAGED - Drawings stacked between chipboards from lowest to highest level, with sufficient rubber bands.
- ☐ X-SHEET INITIALED AND DATED
- ☐ TEST SLIP - Be sure to check status of scene as O.R. or F.T.U., Take 1 or Take 2
- ☐ UNUSUAL SITUATIONS - Explain anything that may confuse the cameraman in a note on the test slip.