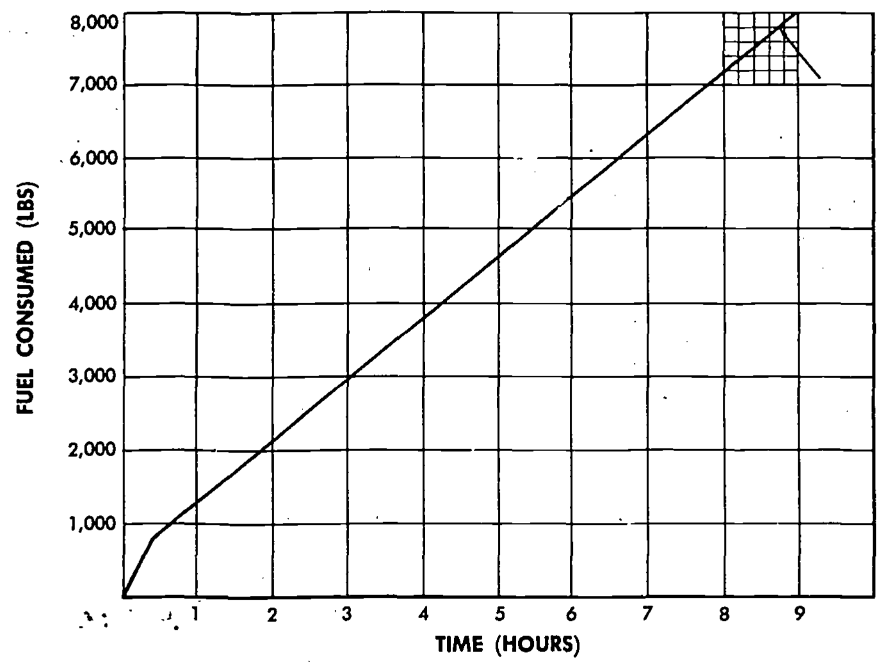

Figure 24-7. Fuel Graph (Conventional)

duces the predicted gross weight of the aircraft on landing.

FUEL ANALYSIS FOR CONVENTIONAL AIRCRAFT. As with jet aircraft, each type of conventional aircraft has a series of fuel graphs. Each graph is based on density altitude, takeoff gross weight, and true airspeed. The fuel graph shown in figure 24-7 is used in completing blocks 1 through 8 on the flight plan shown in figure 24-8.

To use the fuel graph, enter along the top or

NAVIGATOR'S LOG

FLIGHT PLAN	MISSION NO	CREW NO	AIRCRAFT COMMANDER	NAVIGATOR	ACFT (TYPE, MODEL, NO.)
	FM-29	N-10	CAPT. J. LUKACHKO	CAPT. L. ZIRKER	TC 192

DATE	FROM	TO	PA	ORGANIZATION	TAKE OFF GROSS WT
15 APR 1965	MAFB	MAFB	OW #4	T-40	44,000 #

TO	MEA	ALT	TEMP	WIND	IAS	TAS	GS	LEG DIST	LEG TIME	ACCUM TIME	FUEL FOR ACCUM TIME	ACCUM DIST	TC	DRIFT CORR	TH	VAR	MH	ETA / ATA
WILLIAMS VORTAC	—	/	—	180/20	—	157	172	46	16			46	311	-6	305	-18	287	
UKIAH VORTAC	—	/	—	180/20	—	157	159	58	22	38		104	269	-7	262	-18	244	
40-00N 127-30W	6.8	12.0	+5	270/20	154	190	171	203	1:11	1:49		307	286	-2	284	-18½	265½	
39-22N 133-51W	2.0	12.0	+5	270/20	154	190	170	296	1:45	3:34		603	262	+1	263	-19	244	
41-00N 130-00W	2.0	13.0	+3	260/20	152	190	208	202	52	4:32		805	060	-2	058	-19	039	
UKIAH VORTAC	6.8	13.0	+3	260/20	152	190	207	330	1:36	6:08		1135	111	+3	114	-19	095	
MATHER VOR	6.8	13.0	+3	260/20	152	190	208	104	30	6:38		1239	104	+2½	106½	-18	087½	
				/														
				/														
				/														
				/														
				/														
				/														
				/														
TERMINAL ALTERNATE CASTLE AFB	—	13.0	+3	260/20	152	190	192	80	25				162	+6	168	-18	150	

TIME AND FUEL ANALYSIS		
FUEL FLOW PAGE: 15.0 DENSITY	TIME	FUEL
1. ENROUTE	6:38	6050
2. TERMINAL ALTERNATE	:25	
3. (1+2)	7:03	6400
4. 10% RESERVE	:42	600
5. (3+4)	7:45	7,000
6. HOLDING	:45	
7. APPROACH & LANDING	:15	
8. PLANNED T.O.	8:45	7,300
9. TAXI, RUNUP & T.O.		500
10. RAMP — PLANNED		8,300
10. RAMP — ACTUAL		9,000
11. ACTUAL T.O.		8,400
12. (11−8)÷4 PRO RATA		1,200

CLEARANCE:
ATC CLRS DECAL 69 TO MAP
VIA DIR ILA-/T-FPL-T ;2.0
CNTC DPC 121.1 − 318.2

Figure 24-8. Flight Plan (AF Form 21, Navigator's Log) bottom with planned flying time from block 8 (8:45). Proceed vertically to the fuel consumed line and extract the required amount of fuel (7,800 lbs). Log this value in the fuel column of block 8 as shown in figure 24 8. Log the predetermined taxi, runup, and takeoff fuel in block 9 (500 lbs is used for the aircraft in this example). Add blocks 8 and 9 to obtain the planned ramp fuel (block 10).

Upon arrival at the aircraft, determine the actual amount of fuel on board (in this case 9,000 lbs), and log that value in the actual ramp section of block 10. Check the fuel gage again immediately after takeoff and log the amount in block 11 (8,400 lbs).

Pro rata fuel is the actual takeoff fuel minus the planned takeoff fuel, plus the ten percent reserve fuel. It is logged in block 12.

RANGE CONTROL GRAPH. A range control graph, shown in figure 24-9 is prepared by the navigator. It portrays planned, maximum, and actual fuel consumption. It is used to flight plan fuel consumption and serves as an inflight worksheet for comparing actual and planned fuel consumption.

This range control graph is constructed with in-

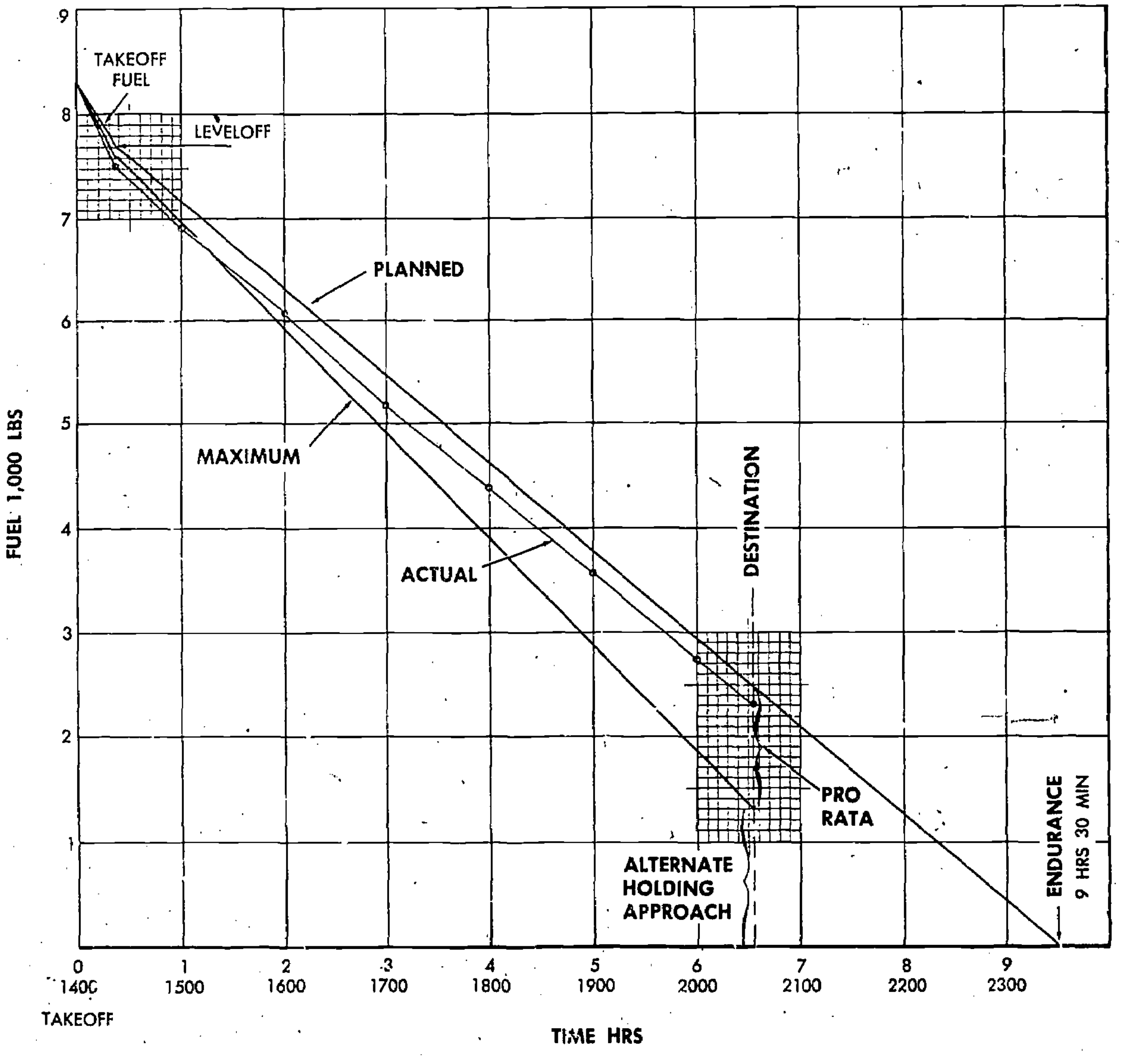

Figure 24-9. Range Control Graph

formation taken from the completed flight plan (figure 24-8) and the applicable fuel graph (figure 24-7). As shown in figure 24-9, fuel remaining (vertical) is plotted against time flown (horizontal). The bottom of the graph represents empty fuel tanks. Plot takeoff fuel on the left side of the graph and use it as the starting point for plotting the fuel consumption lines.

Draw the *planned* fuel consumption line through points representing the planned fuel remaining at takeoff, leveloff, and each hour after takeoff. This line is labeled PLANNED. Compute the fuel remaining at each point by subtracting planned fuel consumed, at each point, from the total takeoff fuel. Draw the planned fuel consumption line to the bottom of the graph to obtain the planned *endurance* (flying time until out of fuel).

The MAXIMUM fuel consumption line represents the highest fuel consumption possible to arrive at destination with sufficient fuel remaining for the alternate, holding, and approach and landing. Compute it by distributing the pro rata fuel (block 12 of figure 24-8) proportionately throughout the flight, using the formula:

$$\frac{\text{Pro Rata Fuel}}{\text{Total Time Enroute}} = \frac{\text{Difference in Max and Planned}}{\text{Time Enroute to Point}}$$

Example for leveloff:

$$\frac{1200 \text{ lbs}}{6{:}33} = \frac{\text{Diff (66 lbs)}}{22 \text{ min}}$$

Compute "Diff" for each point on the PLANNED line. Then plot each difference directly below the point for which it was computed. Thus, each point on the MAXIMUM line represents the minimum amount of fuel remaining for that time of the flight. Draw a vertical line through the total time enroute. Label this vertical line DESTINATION.

As the flight progresses, obtain fuel readings (fuel remaining) and plot on the graph for the time of the fuel reading. Draw a line through these points on the graph and label it ACTUAL. The trend of the ACTUAL line indicates whether the aircraft is following the planned fuel consumption schedule or not.

Equal Time Point

The equal time point (ETP) is a point along the route from which it takes the same amount of time to return to departure as it would to continue to destination. It is usually computed when planning long, overwater flights.

The ETP is not necessarily the midpoint in time from departure to destination. Its location is somewhere near the midpoint of the route, however, and it is dependent upon the wind factors.

A *wind factor* is a headwind or tailwind component which is computed by comparing the average groundspeed (GS) to the true airspeed (TAS). To do this, algebraically subtract the TAS from the GS. When the wind factor is a minus value (GS less than TAS), it is called a *head wind factor;* when it is a plus value (GS greater than TAS), it is a *tail wind factor.* When computing ETP, obtain a wind factor for each half of the route.

Use the following formula to compute a ETP:

$$\frac{\text{Total distance}}{GS_r + GS_c} = \frac{\text{ETP (in miles from departure)}}{GS_r}$$

Total distance is the number of nautical miles from departure to destination. Since ETP is most significant for the overwater portion of a flight, the ETP should be determined from coastal departure points and for alternate landing ponits. GS_r is the groundspeed to return to departure from the ETP. Compute it for the first half of the route by applying the wind factor with the sign reversed to the TAS. GS_c is the GS to continue from the ETP to destination. Determine it by applying the wind factor for the second half of the route to the TAS.

Using the flight plan shown in Figure 24-4, compute the distance to the ETP:

$$\frac{2305 \text{ NM}}{510\text{k} + 450\text{k}} = \frac{\text{ETP (1224 NM)}}{510\text{k}}$$

Total distance is from Ukiah (coastal departure): 2402 − 97 = 2305. Compute the time to the ETP using the average GS on the first half of the route (410k) and the distance to the ETP (1224 NM). Thus, the time to the ETP for the flight shown in figure 24-4 is 2:59 from coastal departure.

Procedure Turn

A procedure turn is a turn begun before the aircraft reaches a turning point. By beginning the turn at a predetermined time and by turning a standard number of degrees per second, the aircraft will roll out on course to the next navigational check point. Consider the procedure turn tables