

HNAT 737 技术问题说明

提示单编号	撰写	校定	批准/日期
TIP737-2020-78-001	曾晶	张桃	羊全流/2020.2.7

标题 操作原因导致的反推灯亮

一、适用性

737NG

二、背景描述

机队中反推故障率较高，其中主要原因是由于 M1767 和 M1766 的电门可靠性不高导致的，但在此类故障中，有一类特别的是使用中带来的。包括未拉到位和收回缓慢。以下结合译码实例来做一说明。在反推故障处置中，建议严格先译码，后排故的思路，提高排故的效率和精度，详细可参见反推的标准排故处置。

三、解释说明

(一)，正常的反推操作

放反推：反推手柄拉起，将作动控制电门及自动油门的预位电门、同步锁电门，首先是同步锁电门通电使左发左右套筒同步锁得电解锁，0.1 秒后反推控制活门组件中的放出线圈和预位线圈通电。

所以可以看出，实际上在放出过程中机组没有作动到位，带来的影响就是可能反推各电门未被激活，或者反推在放出的过程中，还未到位就被提前断电了，导致反推停留在一个所处的角度。

收反推：反推手柄收回，作动预位电门、收上电门和同步锁电门，收上电磁线圈和预位电磁线圈得电激励，此时反推作动筒运动收起。10.5 秒延时继电器断开收上电磁线圈的供电，反推同步锁 18.5 秒延时断电，同步锁断电，收上控制结束。

在收起过程中，实际上 EAU 一直在监控反推的状态，根据不同的手柄位置进行自检。正常情况下收放过程不超过 3 秒，否则都有可能反推灯亮的发生。

(二)，操作案例

1，放反推

正常操作案例：

空地	左发油门杆	右发油门杆	T/R POSN	T/R POSN	LT T/R	DERT T/R	DRT/R	INTRA/T/R	INTRA#LT	T/R	IMRT T/R	IMREV THR	#REV THR	FT/R	SOL	IT/R	SOL
AIR	36.21	36.21	1		-0.5	NOT-DEFLCNOT-DEFLCNOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
GND	36.21	36.21	1		-0.5	NOT-DEFLCNOT-DEFLCNOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
GND	36.04	36.21	1		-0.5	NOT-DEFLCNOT-DEFLCNOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
GND	36.04	25.49	1		-0.5	NOT-DEFLCNOT-DEFLCNOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
GND	26.19	25.49	1		-0.5	NOT-DEFLCNOT-DEFLCNOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
GND	9.67	5.8	20.25	20.25	20	NOT-DEFLCNOT-DEFLCNOT	INTRANS	INTRANS	INTRANS	INTRANS	INTRANS	THR-LMT	THR-LMT	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.8	82.5	82.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.98	102	100	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.98	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.98	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.8	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.98	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.98	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.98	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.98	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.98	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	6.15	5.98	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	12.13	35.86	102	100.25	DEPLOY	DEPLOY	NOT-INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	INTRA#NOT	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK
GND	35.86	35.86	102	100.25	NOT-DEFLCNOT-DEFLCNOT	INTRA#INTRANS	INTRANS	INTRANS	INTRANS	INTRANS	INTRANS	NORMAL	NORMAL	INTERLK	INTERLK	INTERLK	INTERLK

异常操作案例

案例 1：手柄 33 度保持 2 秒然后 31 度保持两秒再拉到 25 度 1 秒即收回反推。

左发油门杆	右发油门杆	无线电高度	1发反推全放出	2发反推全放出	1发反推放出	2发反推放出	1发内锁线圈通电	2发内锁线圈通电
35.2	35.7	0	Not Dep	Not Deploy	FALSE	FALSE	Normal	Normal
33.6	33.8	-3	Not Dep	Not Deploy	FALSE	FALSE	Normal	Normal
33.6	32.2	-3	Not Dep	Not Deploy	FALSE	FALSE	Normal	Normal
31.8	32	-4	Not Dep	Not Deploy	FALSE	FALSE	Normal	Normal
31.6	32	-4	Not Dep	Not Deploy	FALSE	TRUE	Normal	Rev Intrl
25.1	25.7	-5	Full De	Full Depl	TRUE	TRUE	Rev Intrl	Rev Intrl
34.8	35	-5	Full De	Not Deploy	TRUE	FALSE	Rev Intrl	Rev Intrl
34.8	35.2	-4	Not Dep	Not Deploy	FALSE	FALSE	Rev Intrl	Rev Intrl
34.8	34.8	-5	Not Dep	Not Deploy	FALSE	FALSE	Rev Intrl	Rev Intrl
34.8	35	-5	Not Dep	Not Deploy	FALSE	FALSE	Rev Intrl	Normal
34.8	35.2	-5	Not Dep	Not Deploy	FALSE	FALSE	Normal	Normal
34.8	35.2	-4	Not Dep	Not Deploy	FALSE	FALSE	Normal	Normal
34.8	35	-5	Not Dep	Not Deploy	FALSE	FALSE	Normal	Normal
34.8	35.2	-5	Not Dep	Not Deploy	FALSE	FALSE	Normal	Normal

案例 2：手柄从 STOW 位到反推慢车位停留时间接近 8 秒

空地	左发油门杆	右发油门杆	TRDL	TRDR	TRIT1	TRIT2	TRITL	TRITR	TRSIE1	TRSIE2
AIR	47.11	46.76	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NORMAL	NORMAL
AIR	45.53	44.47	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NORMAL	NORMAL
AIR	37.09	35.86	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NORMAL	NORMAL
AIR	35.86	35.86	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NORMAL	NORMAL
AIR	35.86	35.86	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NORMAL	NORMAL
GND	34.45	33.93	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NORMAL	NORMAL
GND	33.05	32.7	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NORMAL	NORMAL
GND	30.59	30.76	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NORMAL	NORMAL
GND	30.23	26.37	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NOT-INTRANS	NORMAL	NORMAL
GND	26.19	26.02	NOT-DEPLOY	NOT-DEPLOY	NOT-INTRANS	NOT-INTRANS	INTRANS	INTRANS	NORMAL	NORMAL

案例 3：双发反推手柄拉出一点后立即收回，右发反推灯亮，译码油门杆从 36.21 度拉到 34.8 度收回，双发反推未放出。

左发油门杆	右发油门杆	1发反推对前推力的限制	2发反推对前推力的限制	1发反推转换	2发反推转换	1发左反推平移罩位置	2发左反推平移罩位置	1发右反推平移罩位置	2发右反推平移罩位置
43.24	43.41			..	..	0	0	0	0
43.24	43.41			..	..	0	0	0	0
36.03	36.21	NORMAL	NORMAL	..	..	0	0	0	0
36.03	36.21			..	..	0	0	0	0
36.03	36.21			..	..	0	0	0	0
36.03	36.21			..	..	0	0	0	0
36.21	36.21	NORMAL	NORMAL	..	..	0	0	0	0
35.68	35.68			..	..	0	0	0	0
35.15	34.98			..	..	0	0	0	0
36.03	36.03			..	..	0	0	0	0
36.03	35.85	NORMAL	NORMAL	..	..	0	-0.25	-0.25	0
36.03	36.03			..	..	0	-0.25	0	0
36.03	36.03			..	..	0	0	0	0
35.85	36.03			..	..	0	-0.25	0	0
36.03	36.03	NORMAL	NORMAL	..	..	0	0	0	0
36.03	36.03			..	..	0	0	0	0
36.03	36.03			..	..	0	0	0	0
36.03	36.03			..	..	0	0	0	0
36.03	35.85	NORMAL	NORMAL	..	..	0	0	0	0

案例 4，双发放出反推的时间较长，系统记录下电门信息。

AIR/GROUND AIRGND				SELID TRA FILTERED 1 ATHRANG1 DEGS				SELID TRA FILTERED 2 ATHRANG2 DEGS				POSN LT SLEEVE 1 TRLGP1 %STROKE	POSN LT SLEEVE 2 TRLGP2 %STROKE	POSN RT SLEEVE 1 TRRGP1 %STROKE	POSN RT SLEEVE 2 TRRGP2 %STROKE
AIR	AIR	AIR	AIR	50.10	48.87	36.21	36.21	49.39	47.81	35.51	35.33	-0.75	-0.75	-0.25	-0.25
AIR	AIR	AIR	AIR	36.21	36.21	36.21	36.21	35.33	35.33	35.33	35.33	-0.75	-0.75	-0.25	-0.50
AIR	AIR	AIR	AIR	36.21	36.21	36.21	36.21	35.33	35.33	35.33	35.33	-1.00	-0.75	-0.25	-0.50
AIR	AIR	AIR	AIR	36.21	36.21	36.21	36.21	35.33	35.33	35.33	35.51	-1.00	-0.75	-0.25	-0.25
AIR	AIR	AIR	GND	36.21	36.21	36.21	36.21	35.91	35.91	35.33	35.33	-0.75	-0.75	-0.50	-0.25
GND	GND	GND	GND	36.21	36.21	36.21	35.16	35.93	36.51	34.98	34.18	-0.75	-0.75	-0.50	-0.25
GND	GND	GND	GND	33.05	33.05	33.05	33.05	31.84	31.82	31.82	31.99	-0.75	-0.75	-0.50	-0.25
GND	GND	GND	GND	33.05	33.05	33.05	31.82	31.89	31.89	31.89	31.29	-0.75	-0.75	-0.25	-0.50
GND	GND	GND	GND	26.37	26.37	26.37	26.37	25.49	25.66	25.66	25.66	-0.75	-0.75	-0.50	-0.50
GND	GND	GND	GND	26.37	26.37	20.21	12.83	25.66	25.66	19.86	9.49	-0.75	14.75	-0.50	14.75
GND	GND	GND	GND	9.84	6.15	6.15	6.15	5.32	5.80	5.80	5.80	26.00	78.75	24.75	79.00
GND	GND	GND	GND	6.15	6.15	6.15	6.15	5.80	5.80	5.80	5.80	90.75	100.75	98.00	100.75
GND	GND	GND	GND	6.15	6.15	6.15	6.15	5.80	5.80	5.80	5.80	99.75	100.75	101.00	100.75
GND	GND	GND	GND	6.33	6.33	6.33	6.33	5.80	5.80	5.80	5.80	99.75	100.75	101.00	100.75
GND	GND	GND	GND	6.33	6.33	6.33	6.33	5.80	5.80	5.80	5.80	99.75	100.75	101.00	100.75
GND	GND	GND	GND	6.33	6.33	6.33	6.33	5.80	5.80	5.80	5.80	100.00	100.75	101.00	100.75
GND	GND	GND	GND	6.33	6.33	6.33	6.33	5.80	5.80	5.80	5.80	100.00	100.75	101.00	100.75
GND	GND	GND	GND	6.33	6.33	6.33	6.33	5.80	5.80	5.80	5.80	100.00	100.75	101.00	100.75
GND	GND	GND	GND	6.33	6.33	6.33	6.33	5.80	5.80	5.80	5.80	100.00	100.75	101.00	100.75
GND	GND	GND	GND	6.33	6.33	6.33	6.33	5.80	5.80	5.80	5.80	100.00	100.75	101.00	100.75
GND	GND	GND	GND	6.33	6.33	6.33	6.33	5.80	5.80	5.80	5.80	100.00	100.75	101.00	100.75
GND	GND	GND	GND	6.33	6.33	6.33	6.33	5.80	5.80	5.80	5.80	100.00	100.75	101.00	100.75
GND	GND	GND	GND	6.50	6.68	10.02	10.02	5.98	5.98	5.32	5.49	100.00	100.75	101.00	100.75
GND	GND	GND	GND	10.02	10.02	10.20	10.72	9.49	9.49	9.67	10.26	100.00	100.75	101.00	100.75
GND	GND	GND	GND	11.07	13.18	18.99	23.20	10.37	12.30	17.55	21.88	100.00	100.75	101.00	100.75
GND	GND	GND	GND	26.72	27.77	36.04	36.04	25.14	24.02	35.33	35.14	100.00	100.75	101.00	100.75
GND	GND	GND	GND	36.04	36.04	36.04	36.04	35.14	35.14	35.14	35.14	100.00	100.75	101.00	100.75
GND	GND	GND	GND	36.04	36.04	36.04	36.04	35.14	35.14	35.14	35.14	78.25	100.75	99.25	100.75
GND	GND	GND	GND	36.04	36.04	36.04	36.04	35.14	35.14	35.14	35.14	19.75	95.50	99.25	49.50
GND	GND	GND	GND	36.04	36.04	36.04	36.04	35.14	35.14	35.14	35.14	-0.75	24.75	49.50	-0.50

2, 收反推的异常操作

案例一：右发反推灯亮，地面检查右发反推无法收回。译码显示右发收反推后未收到位，油门杆角度 33.74 度，右发反推手柄未完全到位。

左发油门杆	右发油门杆	1发左反推平移罩位置	2发左反推平移罩位置	1发反推转换	2发反推转换	1发反推全伸出	2发反推全伸出	1发反推互锁螺线管激励	2发反推互锁螺线管激励
36.38	36.21	0	0	..	..	..	..	NORMAL	NORMAL
36.38	36.21	0	0	..	..	..	..	NORMAL	NORMAL
36.38	36.21	0	0	..	..	..	..	NORMAL	NORMAL
25.83	25.66	0	0	..	..	..	..	NORMAL	NORMAL
25.83	25.66	35.75	8.5	INTRANS	INTRANS	..	..	NORMAL	NORMAL
10.37	10.54	96.25	68	INTRANS	..	..	DEPLOY	INTERLK	NORMAL
10.19	10.37	100	100.75	..	..	DEPLOY	DEPLOY	INTERLK	INTERLK
9.66	9.84	100	101	..	..	DEPLOY	DEPLOY	INTERLK	INTERLK
9.84	10.19	100	101	..	..	DEPLOY	DEPLOY	INTERLK	INTERLK
9.84	10.19	100	101	..	..	DEPLOY	DEPLOY	INTERLK	INTERLK
9.84	10.19	100	101	..	..	DEPLOY	DEPLOY	INTERLK	INTERLK
9.84	10.19	100	101	..	..	DEPLOY	DEPLOY	INTERLK	INTERLK
35.33	33.74	76.25	101	..	..	DEPLOY	DEPLOY	INTERLK	INTERLK
35.33	33.74	20.75	101	INTRANS	..	..	DEPLOY	INTERLK	INTERLK
35.33	33.74	0	101	INTRANS	..	..	DEPLOY	INTERLK	INTERLK
35.33	33.74	0	101	INTRANS	..	..	DEPLOY	NORMAL	INTERLK
35.33	33.74	0	101	..	..	..	DEPLOY	NORMAL	INTERLK
35.33	33.74	0	101	..	..	..	DEPLOY	NORMAL	INTERLK
35.33	33.74	0	101	..	..	..	DEPLOY	NORMAL	INTERLK

案例而：双发反推灯亮，手柄收上时间超过 8 秒，导致双发反推灯亮。

左发油门杆	右发油门杆	1发反推对	2发反推对	1发反推转	2发反推转	左反推转柄	右反推转柄	1发反推全	2发反推全	1发左反推	2发左反推
10.01	9.31	NORMAL	NORMAL	..	..	..	..	DEPLOY	DEPLOY	100.5	99.5
11.42	12.12			..	..	..	..	DEPLOY	DEPLOY	100.5	99.5
13.53	15.29			..	..	..	..	DEPLOY	DEPLOY	100.5	99.5
17.4	17.92			..	..	..	..	DEPLOY	DEPLOY	100.5	99.5
20.03	20.74	NORMAL	NORMAL	..	..	..	..	DEPLOY	DEPLOY	100.5	99.5
24.08	26.19			..	..	..	..	DEPLOY	DEPLOY	100.5	99.5
29	32.34			..	..	..	..	DEPLOY	DEPLOY	100.5	99.5
33.74	34.8			..	..	..	..	DEPLOY	DEPLOY	100.25	99.5
35.33	34.8	NORMAL	THRLMT	INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8	THRLMT	THRLMT	INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.25	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.25	99.5
35.33	34.8	THRLMT	THRLMT	INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.25
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.25	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.25	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.25	99.5
35.33	34.8	THRLMT	THRLMT	INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5
35.33	34.8			INTRANS	INTRANS	INTRANS	INTRANS	..	..	100.5	99.5

四，操作要求

机组使用手册

发动机, APU—
发动机系统说明

海南航空股份有限公司

737 飞行机组使用手册

当指令收回反推手柄时，位于后顶板上的反推灯亮，隔离活门关闭 10 秒钟后该灯熄灭。任何时候只要反推灯亮超过 12 秒钟，则出现故障并且主警戒灯和发动机系统信号牌亮。

注：反推手柄从 1 号卡位向存放位置移动的过程中若出现任何停顿，都可能会引起主警戒灯和发动机系统信号牌灯亮。停顿大约 18 秒钟会接通电子机械锁防止反推套筒继续移动。循环操作反推可以清除故障并恢复正常工作。

五，排故建议

为了避免不必要的人力和航材耗损，建议在反推灯亮后，除及时读取故障代码外，安排对出现故障的航段进行译码来确认是否机组操作问题导致。