行政院及所屬各機關出國報告
（出國類別：研究）

商務飛機關鍵技術與系統開發三年計畫 － 『起落架液壓致動器研製及測試技術資料』技引案訓練見習心得

服務機關：中山科學研究院
第一研究所
出國人職稱：中校技士
中校技士
技術員
姓名：翟志道
劉全輝
于永祥

出國地區：加拿大安大略省多倫多
出國期間：90.12.08 至 90.12.16
報告日期：91.03.20

H2/c0910050/

CSIPW-91F-E0004

國外公差報告

中山科學研究院

國外公差心得報告

批示				
技術媒合之作為本院未來之作業項目，俾使多方。 中山科學研究院副院長宋大維 1152				
中山科學研究院副院長仲澤雋 0400				
公差年度	九0	所屬單位各級主管	政戰部	企劃處
單位	次系統組		已完成資料審查	請將資料上傳行政院研考會網站，並請將報告裝訂四份送貴單位專責人員後轉送本處。電子檔送交本處「公差出國報告信箱」副本送專責人員。
級職	技術員 中校技士 中校技士	第一研究所長張元彬 0808 第一研究所副所長何志遠 0910	政戰部安全組長劉智祥 0410 1100	企劃處處長 0409 1445 企劃處處正蔣雅倫 0409 1240
姓名	于永祥 劉全輝 翟志道	第一研究所次系統組副組長陳志航 0910 第一研究所次系統組機械動力小組長翟志道 0325 1700	政戰部政務副主任顧中深 0410 1105	0409 1400

（九一）一所行會65號

企劃處 91.4.9 收文章

國外進修(公差)人員返國報告主官(管)審查意見表

本次國外公差係配合本所軍民通用經濟部九十年度「商務飛機關鍵技術與系統開發三年計畫」科技專案執行『起落架液壓致動器研製及測試技術資料』技術引進案之技術套件內容解說及工作實習等履約工作，其工作內容包含商務飛機起落架之六型液壓致動器設計、製造、組裝、品保及測試技術等專業訓練事宜。

本次國外公差係由次系統組中校技士翟志道、中校技士劉全輝及技術員于永祥等三員赴加拿大多倫多之世界知名起落架大廠 Messier-Dowty 公司進行前述技術引進案之人員訓練任務，期盼與國際大廠合作，藉由技術引進方式吸收國際大廠之起落架致動器完整研製技術及發展經驗，以有效縮短國內航太業界摸索學習的過程，建立國內開發飛機起落架致動系統及關鍵零組件之設計、製造、組裝、品保及測試技術能量，以配合政府推動航太工業之政策，促使達成航太產業昇級效益之科專案計劃目標。

本次赴加拿大進行起落架致動器之技術引進人員訓練研討及見習，除了能吸取飛機起落架致動器及零組件等設計製造測試關鍵技術並經由技術研討吸收 Messier-Dowty 公司發展起落架致動器經驗，可有效地提升國內商務飛機起落架致動器研製能力，除可以提昇本院軍品自製研發技術外，並可兼顧協助國內航太業界爭取航太另組件 OEM 合作或代工機會。

第一研究所 次系統組 副組長 陳志航

所長 張元彬

依本院 85.11.25（85）蓮菁字 15378 號令，返國報告上呈時應附主官評審意見

報　告　資　料　頁

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CSIPW-91F-E0004	研究	91.03.20	35 頁

5.報告名稱：

商務飛機關鍵技術與系統開發三年計畫 －

『起落架液壓致動器研製及測試技術資料』技引案訓練見習心得

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10.公 差 機 構		中山科學研究院第一研究所
11.附　　記		

系統識別號:C09100501

公 務 出 國 報 告 提 要

頁數: 35　含附件: 否

報告名稱:

商務飛機關鍵技術與系統開發三年計畫 - 『起落架液壓致動器研製及測試技術資料』技引案訓練見習心得

主辦機關:

國防部中山科學研究院

聯絡人／電話:

／

出國人員:

翟志道　國防部中山科學研究院　第一研究所　中校技士
劉全輝　國防部中山科學研究院　第一研究所　中校技士
于永祥　國防部中山科學研究院　第一研究所　技術員

出國類別: 研究

出國地區: 加拿大

出國期間: 民國 90 年 12 月 08 日 -民國 90 年 12 月 16 日

報告日期: 民國 91 年 03 月 20 日

分類號/目: H2／航空　H2／航空

關鍵詞: 起落架致動器、技術引進

內容摘要: 本次國外公差係配合經濟部九十年度「商務飛機關鍵技術與系統開發三年計畫」科技專案執行『起落架液壓致動器研製及測試技術資料』技術引進案之技術套件內容解說及工作實習等工作，依據技引案內容實施商務飛機起落架液壓致動器之技術文件講授及工作實習等事宜。中科院一所派遣次系統組中校技士翟志道等三員赴加拿大多倫多世界知名起落架大廠Messier-Dowty公司進行前述技術引進相關工作，吸取航空起落架致動器及零組件等設計、製造及測試關鍵技術並經由技術研討吸收Messier-Dowty公司發展起落架致動器經驗，可有效地提升國內商務飛機起落架致動器研製能力，協助國內航太業界爭取航太另組件OEM合作或代工機會。本次國外公差已達成計劃預期目標，效益可綜整包含(一)引進航空起落架致動器之設計、製組、檢測等技術可應用於國內航太產業能量籌建及兼顧本院國防研發之雙重目標，並得以兼顧協助國內廠商爭取系統零組件試製或產製合作及代工機會。(二)掌握起落架致動系統關鍵技術發展現況與趨勢、擬定未來航太起落架產業研發衍生計劃。

本文電子檔已上傳至出國報告資訊網

目　錄

壹、出國目的及緣由

為執行經濟部九十年度「商務飛機關鍵技術與系統開發三年計畫」科技專案之『起落架液壓致動器研製及測試技術資料』技術引進案，須派員赴加拿大多倫多Messier-Dowty公司執行起落架液壓致動器技術套件授課及工作實習等任務，因此派遣第一研究所次系統組中校技士翟志道等三員執行本項起落架致動器關鍵技術之設計、製組、檢測及品質系統等技術引進技術轉移訓練工作及技術研討。

一、緣起(派遣事由)：

第一研究所自九十年度起承接經濟部『商務飛機關鍵技術與系統開發三年計畫』科技專案，為了進行『致動系統技術開發子項』之起落架致動系統關鍵技術開發工作，擬藉由技術引進方面與國際知名起落架大廠合作，吸收國際大廠之起落架致動器關鍵技術及研製經驗以落實研製能量並生根於國內航太業界，因而推動『起落架液壓致動器研製及測試技術資料』技術引進案。該項技術引進案係由公準精密機械公司得標，安排加拿大起落架大廠Messier-Dowty公司為技術提供原廠，轉移商務飛機起落架液壓致動之相關設計、製組、檢測及品質系統等關鍵技術。

『起落架液壓致動器研製及測試技術資料』技術引進案執行內容區分為兩大階段，第一階段為轉移技術文件，Messier-Dowty 公司提供商務飛機起落架液壓致動器之相關設計藍圖，品質需求文件及接收測試文件，第二階段為人員訓練見習，本所派員前往Messier-Dowty公司實地接受技術文件講授研討及工作見習。

該項技術引進案已於90年11月完成第一階段工作，Messier-Dowty公司交付起落架液壓致動器相關之技術文件資料。為執行本案第二階段之人員技術引進訓練相關事項，本所必須派員赴加拿大進行起落架液壓致動器相關技術移轉訓練工作，所以派遣第一研究所次系統組中校技士翟志道，中校技士劉全輝及技術員于永祥等三員前往加拿大多倫多

Messier-Dowty 公司接受起落架液壓致動器設計、製組、檢測關鍵技術及品質系統相關訓練事宜，以利提昇液壓致動器關鍵技術與擴散科專成果，促使達成航太產業昇級效益。

二、任務內容說明：

本案由第一研究所次系統組翟志道、劉全輝及于永祥三員前往加拿大 Messier- Dowty 公司執行『起落架液壓致動器研製及測試技術資料』技術引進案第二階段之人員訓練任務，並就計劃執行現況召開研討會，此處出差任務分配如下:

1. 技士翟志道負責技術引進案之設計藍圖、技術文件和引用規範研討及起落架測試見習。
2. 技士劉全輝執行起落架液壓致動器之設計、品保及測試部份之液壓、機械技術需求訓練見習及研討(包含轉向機構、收放致動器等機構設計等)。
3. 技術員于永祥執行起落架液壓致動器之零組件製造過程、組裝程序之實務訓練、儀器裝備操作及見習。

本次任務主要項目有：

1. 接受加拿大 Messier-Dowty 公司提供航空起落架液壓致動系統之設計、製組、測試及品質系統等技術訓練與研討。
2. 搜集商務客機起落架致動器之關鍵技術發展動態以作為未來科專案工作規劃參考依據。

三、工作目標陳述：

1. 完成 Dash-8 商務飛機起落架致動系統設計原理講授及研討。。
2. 完成 Dash-8 商務飛機起落架致動器之設計、製造、測試和品保關鍵技術資料文件講授及研討。
3. 完成 Dash-8 商務飛機起落架測試能量及組裝見習。

4.航空起落架液壓致動器技術引進案執行現況研討。

四、此任務擬蒐集之資料：

1. Messier-Dowty 公司起落架致動器製造組裝技術資料。

2. Dash-8 起落架致動器接收測試相關資料。

3. Messier-Dowty 公司品質系統資料。

貳、公差心得

一、Messier-Dowty 公司簡介

Messier-Dowty 公司(以下簡稱 M-D 公司) 屬於 Snecma 航太集團，年營業額約 5 億 3 千萬美金，主要產品為以飛機起落架系統為主，目前 M-D 公司是世界第二大飛機起落架系統設計製造公司。Messier-Dowty 公司簡介如附件二。M-D 公司在新加坡設有製造維修部門並生產起落架致動器，因為新加坡廠成本過高極需轉型至生產起落架主體之高利率產品，故 M-D 公司有意在台灣建立起落架致動器製造中心。

M-D 公司之起落架系統主要客戶為(1)空中巴士(AIRBUS)集團之大型客機(2)加拿大 Bombardier 公司之商務飛機及區間客機(3)法國達梭公司之戰機。此次引進之六型起落架液壓致動器係使用於 Bombardier 公司 Dash-8 100 型及 300 型商務客機，Dash-8 飛機情況銷售良好，廣泛運用於短程區間運輸，國內航空公司(如立榮公司等)亦採用此型飛機(如圖 1)，該型客機之起落架系統可靠度高使用記錄良好。

圖 1、 Bombardier 公司 Dash-8 100 型及 300 型客機

二、參與人員

本次國外公差目的主要如下：(1)接受 M-D 公司起落架致動器關鍵技術人員訓練。(2) 蒐集航空級起落架致動器技術及市場資料以作為 91 年度科專案「致動系統子項」工作推動及技術開發之參考。

本次技轉工作參與人員分列如下：

(1)Messier-Dowty 公司：

Wendy J Channon (Director, Procurement)

Mark Hopewell (project manager)

Tudor Pietraru (Q. A. Engineering Manager)

Marius Nuica (Q .A. Engineering Specialist)

Leonard Swartz (Quality Engineer/Supplier Development)

Paul Lawson (manufacture engineer)

John Cowan (Designer)

(2)公準公司：李大成 協理

(3)中科院一所：翟志道、劉全輝及于永祥

三、技術引進訓練

M-D 公司非常重視本項起落架致動器技術引進案，針對本階段之技術文件講授及見習訓練課程，M-D 公司本項技術引進案專案經理 Mark Hopewell 積極協調安排該公司之負責 Bombardier 公司 Dash-8 起落架系統工程設計、製造、測試及品保部門資深專業人員參與此次人員訓練見習，藉由專業需求講授，技術文件解說及工程問題研討使吾等對於 Dash-8 起落架致動器有具體之瞭解。訓練課程內部摘要如下:

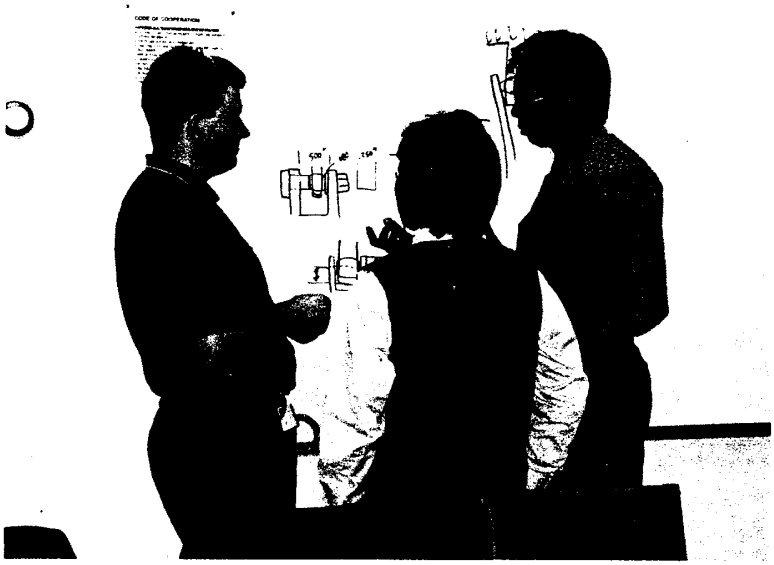

圖 2、 技術文件講授

圖 3、 工程研討

(一)、起落架致動系統功能

本次技術引進案之標的為 Bombardier 公司商務客機 Dash-8(-100 型及-300 型)起落架致動器，其致動器功能簡介如下：

1. 轉向致動器：

轉向致動器是提供飛機於地面滑行控制鼻輪方向以執行轉向控制，使飛機進行所需的轉向動作，它的操作原理是運用液壓缸體內部的活塞移動來帶動兩旁的小活塞桿產生旋轉動作，使鼻輪起落架轉動方向。

2. 10500 主起落架收放致動器：

起飛過程收放致動器收縮使主起落架進行收起動作至固定位置，並使主起落架鎖定在定位所需的位置。降落過程收放致動器伸長可使主起落架放下來至固定位置，使主起落架完全放下以便進行降落。

3. 8900 鼻輪起落架收放致動器：

起飛過程收放致動器收縮使鼻輪起落架進行收起動作至固定位置，並使主起落架鎖定在定位所需的位置。降落過程收放致動器伸長可使鼻輪起落架放下來至固定位置，使主起落架完全放下以便進行降落。

4. 輔助致動器:

輔助致動器之功能係在收放致動器失效的狀況下發揮作用伸長而使收放致動器伸長，使起落架放下。當飛機起飛離地後或將降落前發現起落架無法順利放下來時，可自動驅動收放致動器伸長來強迫起落架放下至定位，使起落架發揮功用安全著地。

5. 阻力支撐致動器:

阻力支撐致動器安裝於主輪起落架，用以支撐主起落架以使其定位而不會因為降落時的衝擊所影響。

6. 穩定致動器:

與阻力支撐致動器連動，使其在收放機構通過中點後連桿機構達到穩定狀態而不會產生回復現象。

(二)、起落架致動器設計

因為 Bombardier 公司商務客機 Dash-8(-100 型及-300 型)起落架致動器是已經 20 年以前的設計，其相關藍圖係採用徒手繪製工程圖而非電腦藍圖，目前 M-D 公司均採用 CATIA 系統應用於相關設計及分析工作。此次訓練課程 M-D 公司將六型致動器及相關零組件實體置放於教室使參訓同仁可得到更好的學習效果。

1. 轉向致動器

轉向致動器(M-D 公司件號 8900-117)主要是由轉向機構(連桿、軸承、自鎖螺帽)、活塞、帽蓋、傳送管、液壓缸本體、開裂式軸承等組件所組成(如圖 4 所示)。轉向致動器構造複雜製造要求高，是本次技術引進的六型致動器中單價最高的，特別是致動器內部的傳送管(transfer tube)之設計及製造精度要求甚高，傳送管表面需要加工車製油封槽(o-ring groove)和特殊表面處理及固潤膜以便安裝油封與背托環(backup ring)達到密封的需求，如圖 5 所示傳送管採用三道 o-ring 及背托環(backup ring)的設計執行封油功能。傳送管內部需要進行深孔加工(deep drill)及堵孔(如圖 6 所示)以完成所需傳油流道。

液壓缸本體係以鍛造件再予以機製加工而成，鍛造件均由向專業廠商採購，其液壓缸本體設計強度約為實際強度的十倍，所以後續加工過程對液壓缸本體造成的傷害及瑕疵仍不會影響設計需求。

傳送管完工後需安裝塑膠網狀套管以免刮傷受損。轉向致動器組裝完成後，必須檢查轉向機構之兩支活塞是否作動順利而不會有遲滯現象，以確保該致動器轉向動作正常。

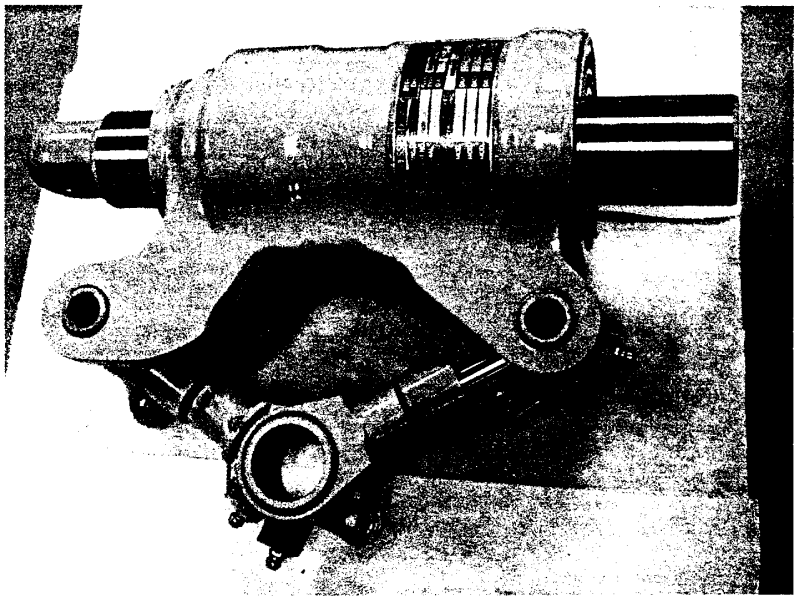

圖 4、轉向致動器

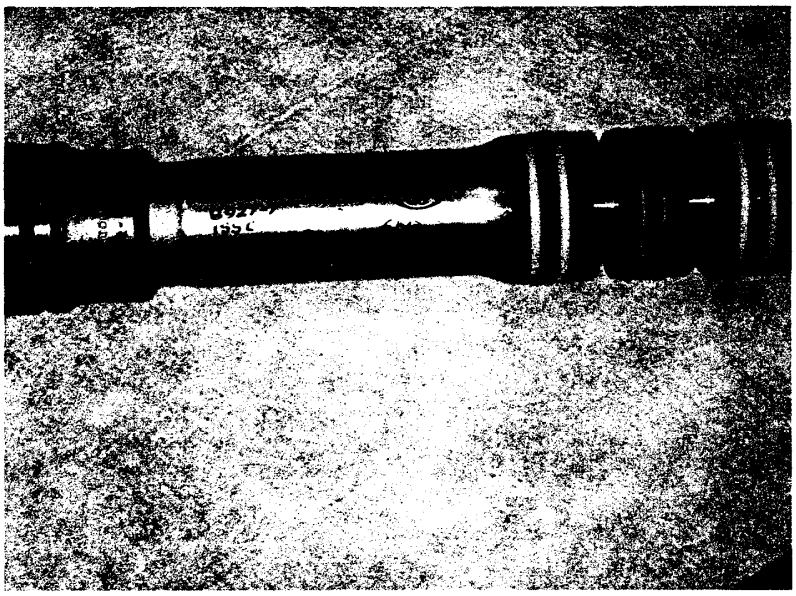

圖 5、轉向致動器傳送管

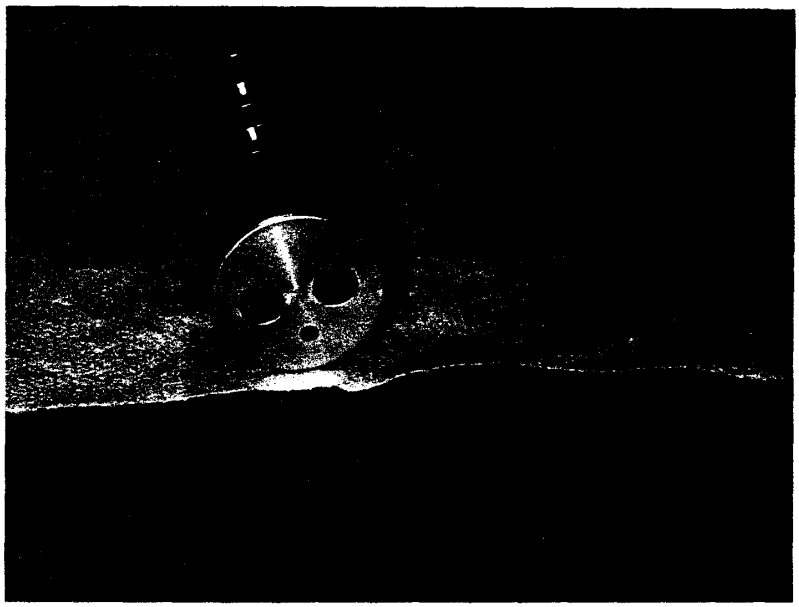

圖 6、轉向致動器傳送管端面設計

2. 收放致動器 (M-D 公司件號 8900-117)

此型收放致動器用於鼻輪起落架，它是由桿端接頭、活塞、帽蓋、傳送管、液壓缸本體、緩衝管等相關零組件所組成(如圖 7 所示)，液壓缸本體係以鍛造件再予以機製加工而成，鍛造件均由向專業廠商採購而非 M-D 公司自行製造，液壓缸本體強度約為實際所需強度的十倍，液壓缸本體足以承受後續加工處理所產生的傷害。

此型收放致動器與機身結構固定之桿端設有一止檔件(如圖 8 所示)，安裝該件的原因係因起落架致動器為 3000psi 高壓力的操作，致動器進油口並非位於致動器中心線所以會產生一力臂，而 3000psi 液壓油高壓作於致動器後因旋轉產生扭矩，為了防止致動器產生旋轉，所以止檔件安裝於與機身結構固定之桿端接頭，以抵抗上述原因所引起之扭矩。

M-D 公司針對致動器的游隙(Freeplay 或 Backlash)控制作法是採用控制桿端接頭內孔與固定銷外徑之間的公差及配接凹槽與

之桿端接頭的公差。在固定銷與孔的配置容差為-0 至+0.0015 吋之間。配接凹槽與之桿端接頭公差配為-0 至 0.005 吋之間，此一需求與 MIL-B-8948A 要求類似。

完工之致動器所有進出油口處均須安裝金屬帽蓋及堵頭，以達到保護進出油口及螺牙不致受到碰撞而凹陷及避免遭受外界污染的需求。

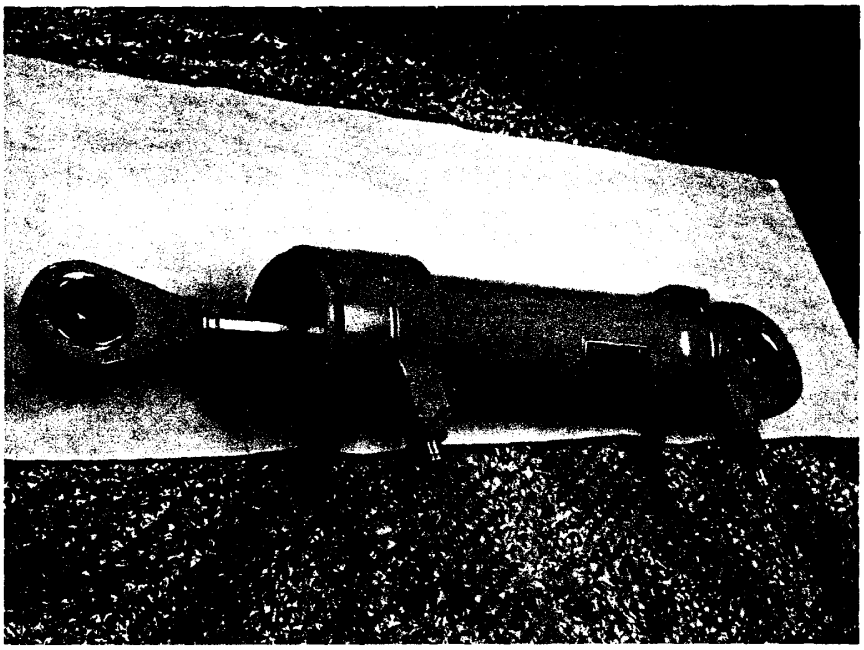

圖 7、收放致動器 8900-117

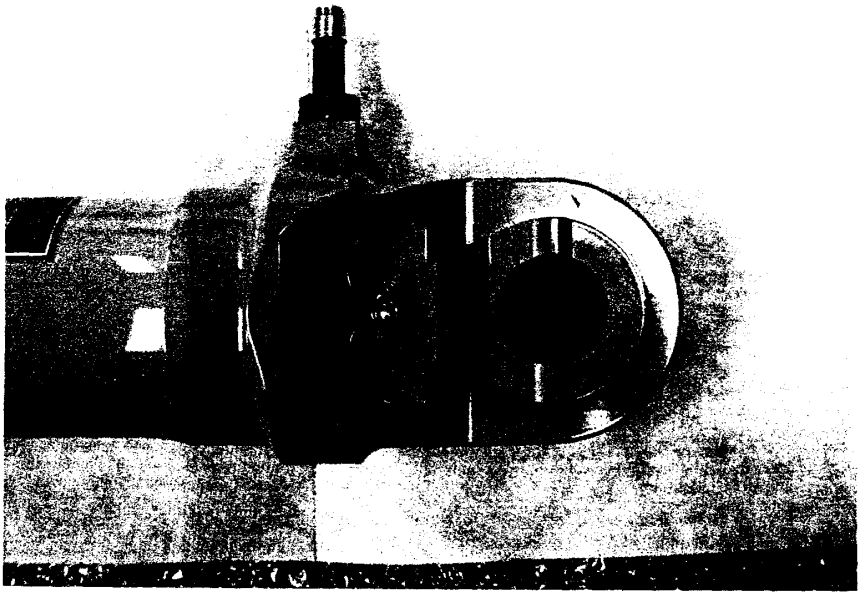

圖 8、致動器桿端抗旋設計

3. 收放致動器（M-D 公司件號 8300-101）

此型收放致動器用於主輪起落架，它是由桿端接頭、活塞、帽蓋、傳送管、液壓缸本體、緩衝管等相關零組件所組成(如圖 9 所示)液壓缸本體係採鍛造件再予以機製加工而成，鍛造件均由專業鍛造廠商提供。

收放致動器與機身結構固定之桿端設有一止檔件，安裝該件的原因係起落架致動器為 3000psi 高壓操作，此型收放致動器進油口並非位於致動器中心線上所以有一力臂長度產生，3000psi 液壓油高壓作動用於致動器後會產生旋轉，如此力臂乘上力就產生了扭矩，為了防止致動器產生旋轉，所以止檔件安裝於與機身結構固定之桿端以抵抗扭矩。

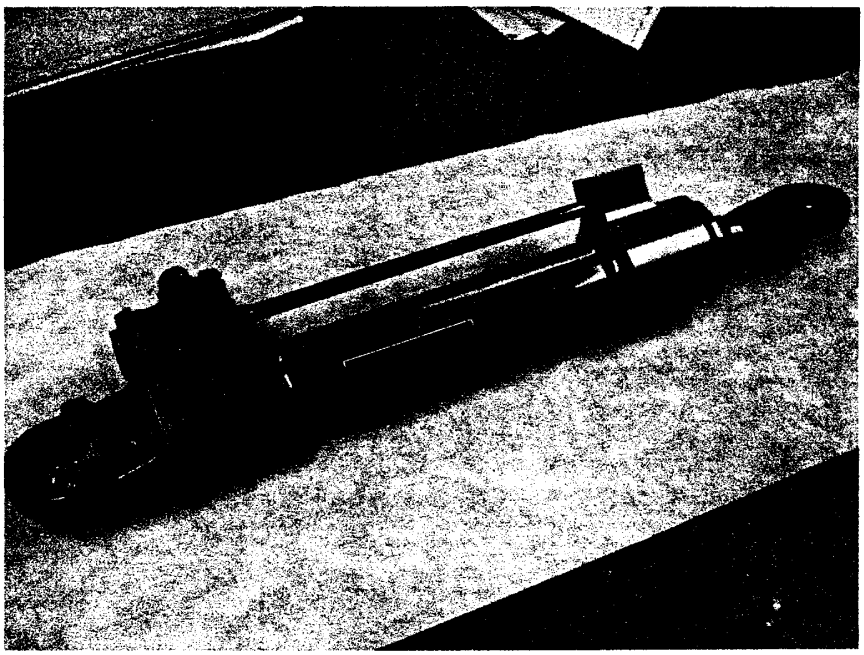

圖 9、收放致動器

4.阻力支撐致動器 (M-D 公司件號 8400-105)

此型阻力支撐致動器是由桿端接頭、活塞、帽蓋、液壓缸本體等相關零組件所組成(如圖 10 所示)， 液壓缸本體係以鍛造件再予以機製加工而成，鍛造件均由向專業鍛造廠商提供再進行後續加工，其液壓缸本體設計強度為實際所需強度的十倍。其輔助致動器兩端之桿端接頭及襯管(bushing)內部均黏貼褐色耐磨之特殊材料，以承受起落架收放操作過程所產生的磨耗。

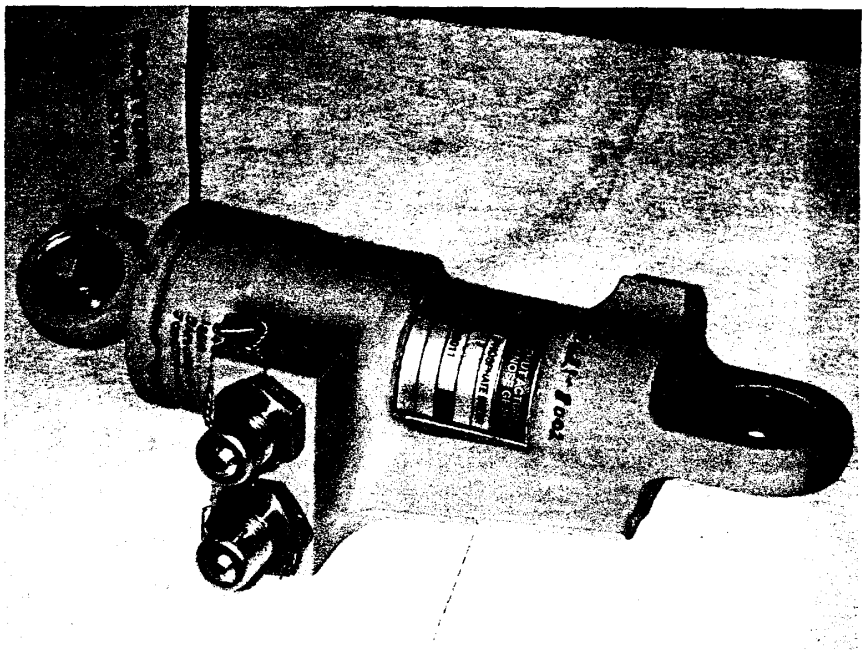

圖 10、阻力支撐致動器 8400-105

5. 輔助致動器 (M-D 公司件號 10600-1)

此型輔助致動器是由桿端接頭、活塞、帽蓋、液壓缸本體等相關零組件所組成(如圖 11 所示)， 液壓缸本體係以鍛造件再予以機製加工而成，鍛造件均由向專業廠商採購，其液壓缸本體設計強度為實際所需強度的十倍。輔助致動器兩端之桿端接頭及襯管(bushing)內部均黏貼褐色耐磨之特殊材料，以承受起落架收放操作過程所產生的磨擦損耗。

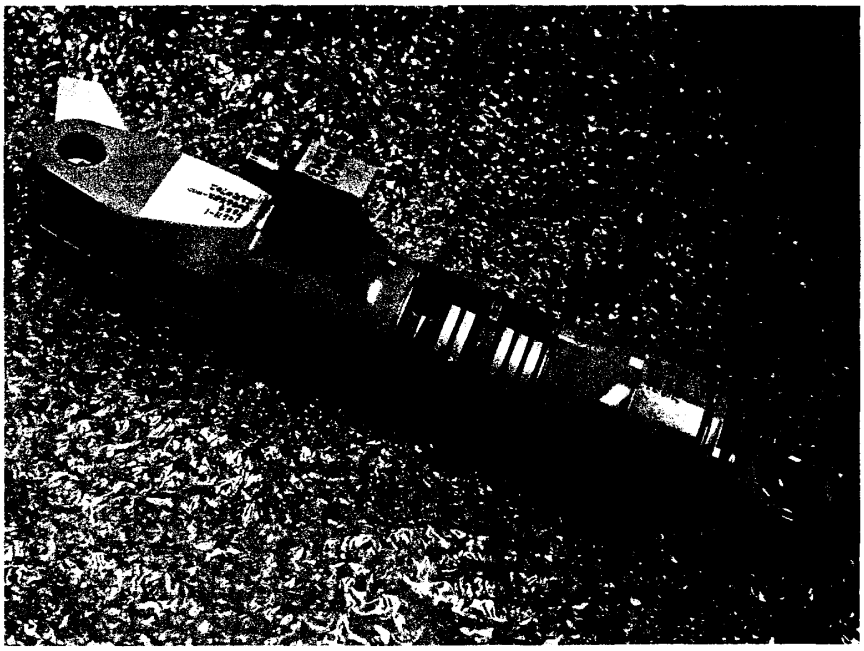

圖 11、輔助致動器 10600-1

6. 穩定致動器（M-D 公司件號 10700-105）

此型穩定致動器是由桿端接頭、活塞、帽蓋、液壓缸本體等相關零組件所組成(如圖 12 所示），液壓缸本體係以鍛造件再予以機製加工而成，鍛造件均由向專業鍛造廠商提供，其液壓缸本體強度遠大為實際所需強度。其穩定致動器中間兩端之定位銷外部及致動器端之桿端接頭均黏貼褐色耐磨之特殊材料，以承受起落架收放操作過程所產生的磨耗。

穩定致動器液壓缸之進出油口處需要刻字作為標示，以方便施工人員判別而不致裝錯管路。液壓缸頂端蓋需執行壓接處理，完成須以紅色油漆劃線標示以作為檢查鬆動之依據。

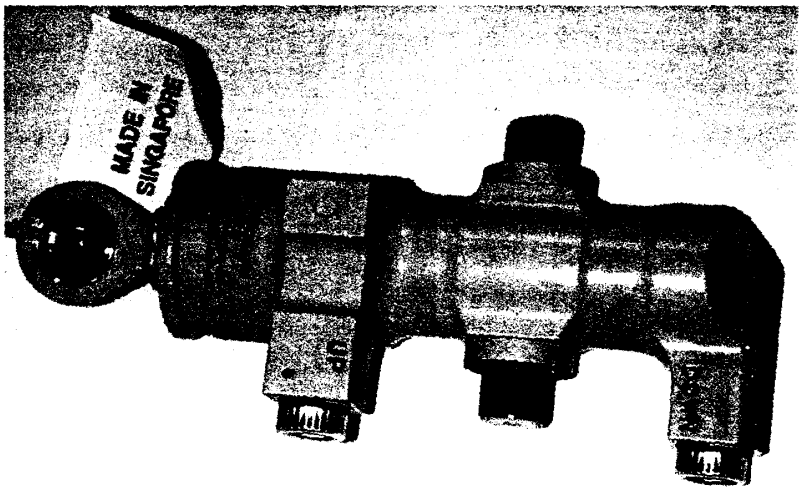

圖 12、穩定致動器 10700-105

M-D 公司的 Dash-8 起落架致動器藍圖並未直接標示零組件重量，當零組件製造完成後，M-D 公司依據藍圖檢驗相關尺寸，只要結果符合藍圖需求即可，而零組件則會於接收檢驗過程執行稱重程序並於 ATP 作記錄。

(三)、致動器製造

起落架致動器特殊製程能量整合部分關鍵製造技術為技術引進重點，目前國內民間廠商技術能量尚不足，M-D 公司認為應整合國內廠商包括漢翔、亞航、華航等公司，以突破現況並且共同建立充足能量，達成彼此資源整合分享的目標。

以下針對 Dash-8 六型起落架致動器製造所需製程除了一般機械加工及內外徑研磨，還需包含珠擊(shot peening)，鍍鎘(cadmium plating)鍍硬鉻(chrome plating)及非破壞檢驗等特殊製程需求，六

型致動器零組件特殊製程需求規納如附件四，而上述的製程需求亦適用於其他機型的起落架致動器。

Dash-8 六型致動器零組件製造過程所需引用之軍用航太規範及 M-D 公司內部規範需求規納如附件三。致動器製造加工過程需要許多工具，夾具及型架配合施工，M-D 公司提供之六型致動器零組件製造所需夾具型架需求如表 1 所列。

起落架致動器因為需要承受飛機降落時之所產生巨大的負載，所以主要承受力量之零組件如活塞桿等均必須使用高強度之合金鋼材料製造。通常使用的材料有 4130、4340、4330 以及 300M，若考量低成本則選用 4130，若需要最大強度/重量比則使用 300M。

重量是飛機零組件設計的考量因素之一，鋁合金材料具備重量輕且切削加工性良好的特性，所以在非主要受力之起落架零件，大量採用鋁合金材料，其中又以 7075- T73 鋁合金材料最為常見。而主要件則以鍛件下料加工。

1.精密加工

(1)機製加工

起落架致動器必須承受飛機降落時之極高負載及多次重覆性之抗疲勞需求，所以機製加工過程對於表面光度有明確之要求，起落架致動器零件表面光度需求可以歸納綜整如下：

鍛胚生料表面光度要求為 250 μin。通常安裝襯套之表面以及鍍硬鉻前之活塞桿表面之光度要求為 125 μin。緊密容差零件(例如液壓缸外徑，搭接旋轉軸環及襯套表面)其光度要求為 63 μin，可採用磨、鉸、搪製加工方式達到。使用於液壓缸之承軸安裝位置之內徑及鍍硬鉻銷之外徑其光度要求為 32 μin，必須靠精搪或研磨加工來達到此要求。活塞桿鍍硬鉻後之外徑及自鎖型液壓缸內徑之光度要求為 16 μin，必須以研磨、搪磨或鏡面加工來

達到此要求。

(2)內外徑研磨

起落架致動器零件之表面光度要求敝須達 32μ in 以上者，通常須以研磨加工方式來達成。研磨加工過程可避免產生應力集中，除需選用適合之研磨冷卻液外，尚必須以適當進給速度方式進行。

2.特殊製程

(1)珠擊

為增加材料抗疲勞及抗應力腐蝕特性，致動器在主要之受力零件，必須於執行表面化學處理前，施以加工。而進行珠擊加工前，必須置放試片，且對於珠擊材料、尺寸大小及施工後外形變化之數量比例、檢驗標準均有明確之規範。

(2)化學處理

起落架致動器零件常用化學處理加工有鍍硬鉻、陽極化、鍍鎘等。除非特別規定，否則材料強度超過 240kpsi 不作鍍硬鉻處理。材料強度超過 150kpsi 應於珠擊前熱處理釋除加工應力，施鍍前必須準備試桿試片驗證溶液設施條件，零件則必須參考相關規範進行清洗、施鍍及完工檢驗。

鍍硬鉻是一種功能性電鍍，主要目的是利用鉻具有耐磨及耐蝕的特性，以提高零件的硬度。適用的零件如活塞桿、機械模具、切削工具。鎘是柔軟帶銀白色亦可塑性的金屬易於展壓。鎘在化合物中以二價金屬存在，可在潮濕的空氣中表面能形成一層氧化膜，所以鍍鎘可保護金屬不受腐蝕且不易發生變化。金屬材料在腐蝕環境中具有活性-鈍化轉變的特性，陽極化處理係利用電化學原理，使金屬表面產生保護性鈍化膜降低腐蝕效率。

3. 非破壞檢測

非破壞檢測(Non-Destructive Testing)是利用物理或機械方法，在不破壞材料的情況下，檢測出材料是否產生缺陷或探測材料物理或機械性質的檢測技術，亦稱為非破壞檢驗(Non-Destructive Inspection)或非破壞檢查(Non-Destructive Examination)。非破壞檢測是航太工業檢測的重要方法。特別是重要而需全檢的零件，必需藉著非破壞檢測亦不破壞零件的特性，使產品能在使用期間做檢測，通常利用非破壞檢驗做為判斷產品堪用性的檢測。茲將起落架致動器零件常用之非破壞檢驗方法簡述如下：

(1)液滲檢測法(Liquid Penetration Testing)

利用毛細孔原理使著色滲透液滲入試件表面之間隙如裂縫氣孔等，除去殘留於表面之滲透液後，再用顯像劑將間隙內之滲透液吸出附著於試件表面，再以目視檢視其缺陷。此法常用於檢驗非多孔性材料之表面缺陷。液滲檢測的基本步驟可分成前清理、滲透、清除滲透液、顯像、檢視五個基本程序。

(2)磁粒檢測法(Magnetic Particle Testing)

此法利用磁粒會聚在磁漏處之原理，建立磁場於磁性材料試件，再施加磁粒於試件表面，試件表面若有缺陷，則會在試件表面形成磁漏而聚集磁粉形成缺陷指示，以供檢驗人員判讀。通常應用於檢驗鑄件、鍛造件、機械加工或研磨零件等磁性材料表面之缺陷。

4. 起落架零組件製程

M-D 公司並提供 BD100 起落架之零組件製程資料(如附件四)供我方參考，由該製程資料可清楚瞭解整個起落架零組件的所有製造工作項目需求及製造流程，由該資料可瞭解製造 M-D 公司對於起落架

零組件之 critical pass 定義，製造所需資源及合理的工作期程，非常值得國內航太業界參考。

表 1 製造夾具型架清單

ITEM	DWG NO.	DWG TITLE	NOTE
1	01 TFB-8310-1	EXPANSION COLLET	
2	01 TFA-8320-1	COLLET	
3	1 DFA-8320-1	DRILL JIG	
4	01 MFA-8320-1	MILLING FIXTURE	
5	01 TFB-8320-1	SPLIT COLLET	
6	01 TFC-8320-1	SPLIT COLLET	
7	1 MFA-8402-5	MILLING FIXTURE	
8	1 MFA-8402-5	MILLING FIXTURE	
9	00 CFA-8406-1	HARDNESS TEST FIXTURE	
10	01 TAA-8902-7	TOOL ADAPTOR	
11	01 GFA-8904-5	GRINDING FIXTURE	
12	01 GFB-8904-5	GRINDING FIXTURE	
13	01 MFA-8904-5	MILLING FIXTURE	
14	01 MFB-8904-5	MILLING FIXTURE	
15	10 MFB-8904-5	MILLING FIXTURE	
16	01 MFC-8904-5	MILLING FIXTURE	
17	01 MFD-8904-5	MILLING FIXTURE	
18	01 MFE-8904-5	MILLING FIXTURE	
19	01 MYA-8904-5	MYLAR TEMPLATE	
20	01 TFA-8904-5A	TURING FIXTURE	
21	01 TFA-8904-5B	TURING FIXTURE	
22	01 HFA-8904-7	HEAT-TREATMENT FIXTURE	
23	01 DFA-89179-1	DRILL JIG	
24	01 GAA-8917-1	FUNCTIONAL DEPTH GAGE	
25	01 GFA-8917-1	GRINDING FIXTURE	
26	01 MFA-10512-7/551	COLLET	
27	01 MFA-10512-7 01 MFA-10512-551	MILLING FIXURE	
28	1 DJA-10512-551	DRILLING JIG	
29	01 MFA-10516-1/551	MILLING FIXTURE	
30	01 TFB-10516-1/551	GUIDE BUSH FOR GUNDRILL M/C	
31	01 MFA-10611-1	MILLING FIXTURE	
32	01 TFB-10704-9	TURING ADAPTOR	

（四）、致動器測試

Dash-8 飛機液壓系統係採用 Skydrol 500B-4 液壓油(如附件五)而不是使軍用飛機常用的 MIL-H-5606 液壓油，兩種液壓油之主要差異在於的黏滯性及 Skydrol 500B-4 的耐火性較優良，Skydrol 500B-4 液壓油之相關特性資料請參考附件三。目前 M-D 公司設計之商用飛機起落架系統使用油品均為 Skydrol 500B-4，故此六型起落架致動器之測試均須以 Skydrol 500B-4 液壓油為測試用油。

Dash-8 六型起落架致動器之測試型架件號請參考如表 1 所列，起落架致動器接收檢驗測試項目包括行程測試、試車、行程速度、操作測漏等。針對致動器測試程序作說明：

1. 轉向致動器接收測試

起落架致動器功能測試需求之建立必須合乎接收測試程序標準，測試需求包含液壓油種類、液壓油潔淨度、流量需求、壓力表精度、液壓油溫度、測試壓力需求、固定型架等。轉向致動器測試儀器及環境需求如表 2 所列請參考。

表 2、轉向致動器測試儀器及測試需求

液壓油種類	Skydrol 500B-4
液壓油潔淨度	符合 NAS 1638 標準
流量需求	當壓力為 3000psi 其流量須達到 2gpm
壓力表需求	a. 0～5000psi ±1.5%誤差值 b. 0～100psi ±2%誤差值
液壓油溫度	38° ± 17℃
測試壓力需求	操作壓力 3000±100 psi 保證壓力 4500±100 psi 回程壓力 5±3 psi
固定架型號	FIXTURE CTR 5102-1E FIXTURE CTR 5102-2

轉向致動器安裝於測試裝備並連接相關液壓管路及儀表後便可執行測試(如圖 13)，轉向致動器之接收檢驗測試項目及測試程序如下

(1)試車：

檢測項目：檢視轉向致動器本體移動是否順暢。

測試程序：

A. 將插銷裝入致動器本體凸耳和移動槽上。

B. 分別加壓 3000psi 壓力於兩油口上，使得致動器本體在移動槽上動作。

(2)保證壓力和外部測漏：

檢測項目：觀察轉向致動器有無外漏液壓油現象、油封處無洩漏液壓油跡象及有無產生永久變形。

測試程序：

A. 當致動器本體行程位於中行程時，將致動器本體以插銷固定住。

B. 分別在兩個油口上同時注入 5psi 壓力並維持 3 分鐘。

C. 分別在兩個油口上同時注入 4500psi 壓力並維持 3 分鐘。

(3)測試致動器之靜摩擦壓力

檢測項目：當轉向致動器本體左右移動時的壓力值不得超過 40psi。

測試程序：

A. 在油口 B 上施加壓力，

B. 並以手感覺致動器本體是否移動並記錄壓力。

(4)致動器行程測試：

檢測項目：轉向致動器行程必須介於 3.477 到 3.517 英吋之間。

測試程序：

A. 在油口 A 上施加壓力，推動致動器本體，量測並記錄位置。

B. 在油口 B 上施加壓力，推動致動器本體，量測並記錄位置。

C. 計算轉向致動器行程距離。

(5)操作測漏和外部測漏

檢測項目：開口端洩漏量不得超過 60cc/min。

測試程序：

A. 將插銷裝入致動器本體凸耳和移動槽上。

B. 分別在油口 A 和油口 B 加壓 3000psi 壓力，使得致動器本體反覆來回作動 100 次。

C. 量測並記錄洩漏量和液壓油溫度。

(6)量測活塞油封內部測漏

測試項目：操作循環 100 次時其洩漏量不得超過 4 滴。

測試程序：

A. 當致動器本體行程位於中行程時，將致動器本體以銷固定住。

B. 油口一端加壓 3000psi，一端量測其洩漏量。

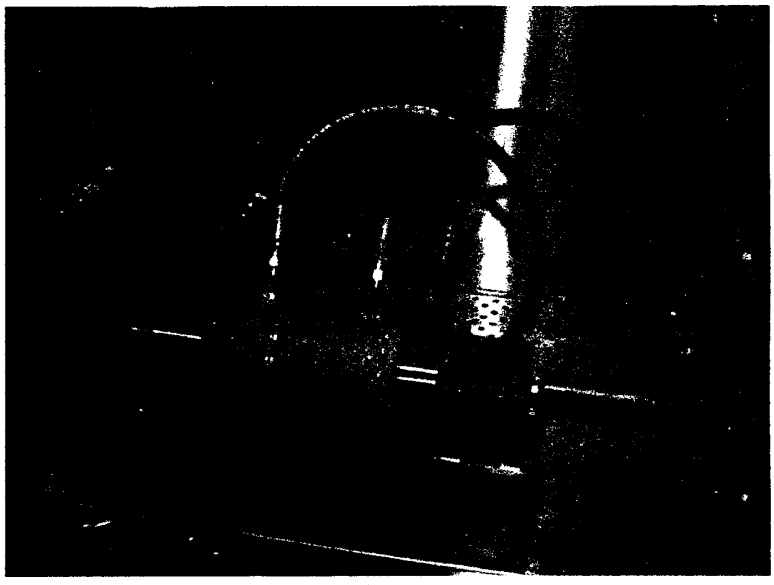

圖 13、轉向致動器測試

表 3、 測試型架清單

致動器型號 Document No.	固定座型式 Fixture type
ATP-10500 收放致動器	Fixture CJ 5026-1D
ATP-10600 輔助致動器	Cyclic Fixture CJ5025-1D
ATP-10700 穩定致動器	Fixture CJ5024-1D
ATP-8300 收放致動器	Fixture CJ4968-1D
ATP-8400 阻力支撐致動器	Fixture CJ5027-1D
ATP-8900 轉向致動器	Fixture CTR 5102-1E Fixture CTR 5102-2

2. 收放/輔助/穩定及阻力支撐致動器測試程序

收放/輔助/穩定及阻力支撐致動器之構造及功能類似，所以這些致動器之測試儀器及環境需求與轉向致動器之需求(如表 2 所列)除了測試型架不同外，其餘需求均相同。而其測試項目亦較轉向致動器少，測試項目為安裝試車測試，行程速度測試，低壓測漏及 4500PSI 保證壓力測漏。

安裝試車係檢視致動器本體移動是否順暢，行程速度測試係測試致動器作動用行程與速度，低壓測漏係通壓維持 3 分鐘檢查內漏和外漏跡象，保證壓力測漏係 4500PSI 保證壓力通壓維持 3 分鐘檢查內漏和外漏跡象。

（五）、起落架測試能量

本次訓練見習特別安排前往其工程部測試單位參訪其起落架測試能量，M-D 公司測試棚廠與設計部門相臨，其測試項目包含起落架疲勞測試，起落架 drop test，起落架系統整合測試等，M-D 公司起落架測試能量非常完善，令人印像深刻。由於其測試能量較為敏感，M-D 公司人員表示起落架相關測試能量係屬敏感項目，所以禁止拍照攝影。

1. 起落架疲勞測試:

測試型架安裝起落架本體及週圍局部固定結構，疲勞測試是用來反覆模擬飛機使用過程起落架執行起飛/降落動作，以驗證起落架本體及固定結構之設計是否符合設計需求，是否滿足設計規範定義起落架應能承受起飛/降落次數而不會產生結構破壞現象。目前該測試棚廠正在執行工程修改後之 F-18 主起落架疲勞測試。

2. 起落架 drop test:

起落架及致動器設計完成後必須執行 drop test，此項測試裝備非常龐大約四層樓高，將測試的起落架安裝於固定平台，測試前先將固定平台上升至高大的 drop test 測試型架頂端，測試開始將起落架固定平台釋放墜落而下，以驗證起落架是否能承受設計規範所定義之落地速度而不會損壞或產生裂痕及驗證起落架減震支柱(shock strut)之減震效果及回彈(rebound)特性。由本項起落架 drop test 可驗證起落架強度是否充足，減震支柱之減震設計是否合於需求。

測試型架及裝備需要模擬起落架所承受機身重量及飛機設計所需承受之落地速度。目前該起落架 drop test 測試型架正在執行 V-22 垂直起降飛機之主起落架 drop test。

3.起落架鐵鳥整合測試:

它是將完整的起落架系統與相關液壓系統安裝於鐵鳥(iron bird)測試型架進行機電整合測試,以驗證起落架系統收放功能是否順暢符合需求，座艙內部之起落架操控邏輯是否正常，液壓系統與起落架是否匹配。目前該測試棚廠正執行 Bombardier 公司最新開發的 BD100 商務飛機之起落架系統鐵鳥測試，測試型架安裝壹具鼻輪起落架，兩具主起落架，相關液壓系統原零組件及電氣裝備。

(六)、起落架系統組裝

M-D 公司之起落架系統組裝過程可分為兩階段,首先第一階段將 M-D 公司協力廠商製造並完成接收檢驗的致動器等起落架之相關零組件進行組裝，因為 M-D 公司有一套嚴謹的供應廠商管制流程，基本上 M-D 公司不再針對各別協力廠商提供的零組件進行測試檢驗，M-D 工廠執行起落架相關零組件組立,如圖 14 及圖 15 所示起落架於型架上完成組立裝配。如果供應廠交運零組件於組裝過程產生問題，則 M-D 公司便會在針對產品有問題的供應廠商進行再次查核。

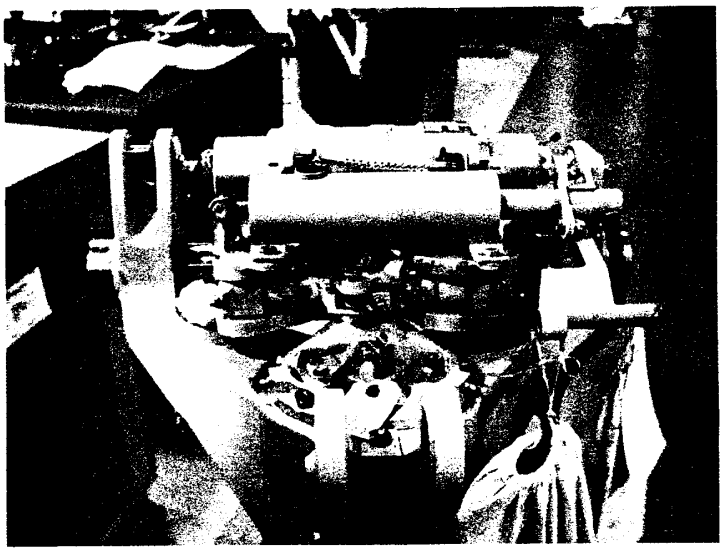

圖 14、轉向致動器組裝

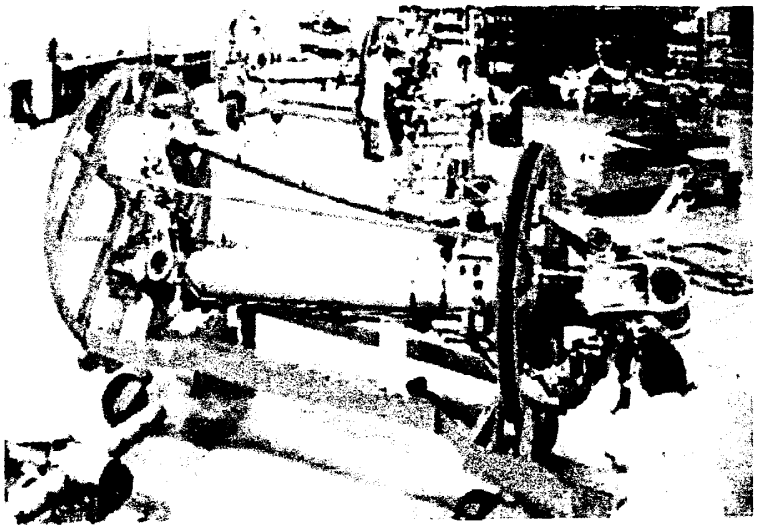

圖 15、起落架組裝

M-D 公司於組裝第二階段則將組立完成的起落架運送至多倫多國際機場旁邊的 Bombardier 公司飛機裝配廠進行最後裝機及起落架系統功能測試，M-D 公司在該處亦進駐有工程技術單位以處理裝配現場所發生之工程問題。Bombardier 公司完成所有飛機系統組裝後，便直接在利用該機場進行測試

M-D 公司安排本所同仁前往 Bombardier 公司飛機裝配廠見習起落架組裝及起落架系統功能測試。此行實地參訪 Bombardier Dash-8 及 Globe Express 商務客機裝配線見習，由 M-D 公司駐場工程經理現場解說此兩型起落架組裝程序及系統測試流程與注意事宜。

（七）、品保系統

加拿大 M-D 公司主要負責起落架系統之設計開發工作，在全球化規劃下許多細部零組件多交由其他地區的工廠(例如新加坡廠及大陸蘇州廠)或採取 OEM 方式交由協力供應商依據設計藍圖製造以便節省研發時程及降低製造程本。所以 M-D 公司針對供應商之品保系

統有嚴謹的管制作為以要供應商製程及品保流程均能符合 M-D 公司的標準，以利委外製造產品均能符合該公司之設計需求。

M-D 公司內部文件 PRIDE (Process Requirement In Developing Excellence)便有章節針對零組件製程核准、型態管制、首件檢查(first article inspection)、不符合零件(non-comformance part)處理、交貨處理及相關文件表格均有詳細要求，相關內容請參考附件六 Summary of PRIDE Requirement。

製作完成之成品在品保檢驗上，只要符合藍圖上的公差範圍內，則屬檢驗合格。若零件發生製造的錯誤或超過誤差範圍，此既為不符合零件，則必需通知 Messier-Dowty 公司相關部門進行評估，Messier-Dowty 公司會組成 MRB 進行檢討，若經過工程及品保人員評估同意許使用則該件為可用件繼續使用，若無法接受則該零件必須立即報廢。

四、綜合觀感

M-D 公司佔全世界起落架之 33%市場佔有率，其市場佔有率為全世界第二位。全球起落架市場規模達 16 億美金/每年，其中 M-D 公司起落架系統產值約為 5.6 億美金/每年。位於加拿大多倫多 M-D 公司員工約 700 餘人，組織人力精簡且具有競爭力。

M-D 公司為了有效降低成本縮短研發期程及分攤風險，大量的零組件均交由外包供應商負責製造，而將核心能量集中於產品研發創新的任務，使公司運作富有彈性。面對為數眾多的供應商，因此 M-D 公司建構一套完整而嚴謹的管理作業流程，確實要求供應商的製造設備、製造程序、測試程序及品保制度完全符合 M-D 公司的規定，所以 M-D 公司有實力堅強完整的品保部門以便管理供應商與委製零組件。

我方人員執行起落架液壓致動器之製造、組裝實習過程欲進入廠房內均被要求配帶護目鏡。進入廠房後看見每位員工均佩帶護目鏡，工安工作執行非常澈底。 M-D 公司積極推動 6S 運動，看板管理及 ISO 制度以有效提昇公司競爭力。

Dash-8 起落架液壓致動器之設計及功能需求與軍用液壓致動器非常類似，惟其製造技術較為嚴謹繁複，藉由本項技術引進案有助於提升我國航空系統件設計開發與精密加工技術，特別是航空用相關特殊製體系的建構程更是重要。

在 M-D 公司細心規劃充分準備下，『航空起落架液壓致動器研製及測試技術資料』技術引進案訓練見習順利完成任務，由技引案執行研討會 M-D 公司對於本所之事前準備(如附件七)及全案推動情況深表滿意。此次訓練見習對於商務飛機起落架液壓致動器的研製技術開發甚有助益，對於國內航太廠商製程提升亦有幫助。

參、效益分析：

本次前往加拿大 M-D 公司執行『航空起落架液壓致動器研製及測試技術資料』技引案訓練見習之效益可規納如下：

一、落實航空起落架致動系統設計、製組、檢測及品質系統等技術移轉工作，得以兼顧本院國防研發能量提升及推動國內航空起落架致動系統產業籌建的雙重目標。

二、能掌握起落架致動系統等關鍵技術發展現況與趨勢，有助於未來航太關鍵技術研發衍生計畫之擬定與爭取建案。

三、可廣泛蒐集起落架致動系統技術資料，除得以提升本院軍品自製研發能量外，另得以兼顧協助國內廠商爭取系統零組件試製或產製合作及代工機會。

肆、國外工作日程表：

日期	星期	行程		公差地點			工作項目
		出發	抵達	國名	(州)省	城鎮	
90 12 08	六	台北	舊金山	美國	加州	舊金山	搭機途中。
90 12 09	日	舊金山	多倫多	加拿大	安大略省	多倫多	轉機及資料整理。
90 12 10	一			加拿大	安大略省	多倫多	起落架致動器系統技術引進案訓練課程： (翟志道)計畫管制、轉向致動器收放、阻力支撐之技術套件文件審查。 (劉全輝)轉向、收放、阻力支撐致動器設計及測試技術套件內容審查。 (于永祥)轉向、收放、阻力支撐致動器製造及組裝程序技術資料審查。
90 12 11	二			加拿大	安大略省	多倫多	起落架致動器系統技術引進案訓練課程： (翟志道) 計畫管制、穩定致動器、輔助致動器之技術套件文件審查。 (劉全輝)穩定、輔助致動器設計及測試技術套件內容審查。 (于永祥) 穩定、輔助致動器製造及組裝程序技術資料審查。
90 12 12	三			加拿大	安大略省	多倫多	起落架致動器系統技術引進案訓練課程： (翟志道) 計畫管制、收放致動器、阻力支撐致動器之技術套件文件審查。 (劉全輝) 收放、阻力支撐致動器設計及測試等工廠實作。 (于永祥) 收放、阻力支撐致動器製造及組裝程序等工廠實作。
90 12 13	四			加拿大	安大略省	多倫多	起落架致動器技術引進案品質暨履約研討： (翟志道)轉向致動器、穩定致動器、輔助致動器之工廠實習內容審查。 (劉全輝)轉向、穩定、輔助致動器設計及測試等工廠實作。 (于永祥) 轉向、穩定、輔助致動器製造及組裝等工廠實作。
90 12 14	五			加拿大	安大略省	多倫多	工程研討及技引案計畫執行檢討。
90 12 15	六	多倫多	舊金山	美國	加州	舊金山	資料整理及搭機返國
90 12 16	日	舊金山	台北				返國飛行

伍、社交活動：

本次赴加拿大國外公差因為行程緊湊，加拿大 Messier-Dowty 公司安排充實的技術引進案訓練見習課程及相關討論外，幾乎沒有額外可用時間與廠商進行社交活動，僅在 Messier-Dowty 公司內部相關單位及設施參訪。圖 16 為 Messier-Dowty 公司人員陪同參訪過程於公司大廳合影留念。

圖 16、Messier-Dowty 公司大廳合照

陸、建議事項

中科研第一研究所 90 年度執行經濟部「商務飛機關鍵技術與系統開發三年計畫」，其中明訂「起落架致動系統技開發」為重要執行工作項目，M-D 公司為世界第二大起落架廠商，此次藉由『起落架液壓致動器研製及測試技術資料』技術引進案與 M-D 公司合作， M-D 公司轉移 Dash-8 商務飛機起落架六型致動器之關鍵技術給我方，使中科研第一研究所在既有的軍用液壓致動器研製能量更加獲得提昇，得以切入商用飛機起落架零組件研製的領域。相關起落架液壓致動器製程，測試技術及品保體系亦可轉移至國內配合廠商以提昇國內航太業界的競爭力，增取國際航太大廠 M-D 公司之 OEM 訂單。

起落架致動器的製造需求非常適合國內精密加工能量，所以此次技術引進案是我國航太業切入國際航太起落架致動器的契機，利用國外大廠引入之關鍵技術，並結合國內企業之優越製造管理能力，應可輔導國內相關業者成立起落架零組件社群，朝向亞太起落架致動器製造中心的規劃推動。

目前 M-D 公司在全球化運籌管理及降低成本考量，積極尋求新的合作供應商承接零組件製造，M-D 公司表達將合適的台灣航太廠商納為該公司之協力廠之意願，特別是經歷美國紐約 911 恐怖事件後使得航太業深受影響，M-D 公司亦積極尋求風險分攤的合作夥伴共同參與新產品開發設計工作。建議商務飛機科專案計劃專案室在推動起落架致動器技術開發之餘，仍可持續關注國際起落架市場之發展演變，尋求對於國內航太業者有利的機會，選擇合適之標的繼續協助國內業者建立起落架零組件關鍵技術能量並爭取國外大廠釋出的訂單。

附件清單：

附件一： Messier-Dowty 公司參與本次技引案訓練人員名片

附件二： Messier-Dowty 公司之簡介

附件三： 致動器引用規範

附件四： 致動器製程流程資料

附件五： Skydrol 500 液壓油資料

附件六： Messier-Dowty 品保資料

附件七: 中科院第一研究所向 M-D 公司簡報之技引案現況資料

附件一

Messier-Dowty 公司參與本次技引案訓練人員名片

附件一： Messier-Dowty 公司參與本次技引案人員名片。

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Buyer
Acheteur

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Directeur de l'approvisionnement

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Procurement Manager
Gérant de L'approvisionnement

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Spécialiste / Ingénieur Qualité

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John Cowan
Designer
Concepteur

Messier-Dowty Inc.
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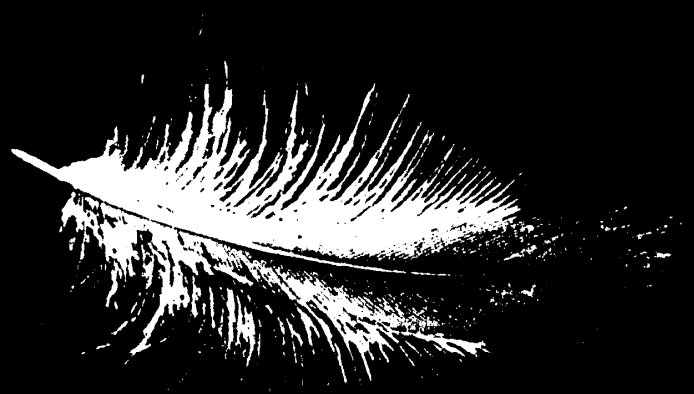
Telephone 905 683 3100 Fax 905 686 3495
E-mail john.cowan@messier-dowty.on.ca

附件二

Messier-Dowty 公司之簡介

We make
landing
more than
250 tons at
160 mph
feel like
this.



THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
snecma group

WORLD LEADER

Design, manufacture and support of landing gear for commercial / military aircraft and rotorcraft

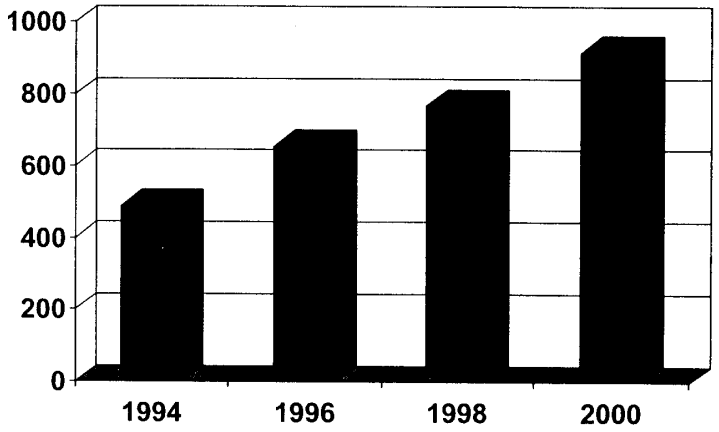
16,000 aircraft equipped:

- **30 airframer customers**
- **750 commercial/military operators**
- **over 30,000 landings per day**
- **one landing every 3 seconds**

2000 sales: US $ 540 million

2,900 employees throughout 8 sites worldwide

Total Messier-Dowty LG Deliveries



A Single Corporate Entity

3 Customer Focused Business Units	4 Common Resource Divisions

Messier-Dowty

1 Corporate Executive Office

MESSIER-DOWTY STEERING COMMITTEE

Chairman & CEO

Louis Le Portz

Senior Vice-President

Martyn Hurst

Corporate Executive Office

Legal **(Gérard Joucla);** ***Quality*** **(Philippe Martin);** ***Research & Technology*** **(Patrick Monclar);** ***Human Resources*** **(Claude Mathieu);** ***Public Relations*** **(François Roudier)**

Airbus BU	Boeing & Military BU	Business & Regional Aircraft BU	Engineering & Testing	Production	Customer Services	Finance
Group VP Daniel Abehsera	Group VP Simon Luxmoore	Group VP Ken Laver	Group VP Pierre Woerner	Group VP Guy Giard	Group VP Daniel Gruaz	Group VP Georges de Chaisemartin

THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
snecma group

A CUSTOMER - ORIENTED ORGANIZATION



Engineering & Testing
Pierre Woerner

Finance
Georges de Chaisemartin

Production
Guy Giard

Customer Services
Daniel Gruaz

Airbus Business Unit
Daniel Abehsera

Boeing & Military Business Unit
Simon Luxmoore

Business & Regional Aircraft Business Unit
Ken Laver

CORPORATE EXECUTIVE OFFICE
VELIZY, FRANCE

LEGAL

Gérard Joucla

QUALITY

Philippe Martin

RESEARCH & TECHNOLOGY

Patrick Monclar

HUMAN RESOURCES

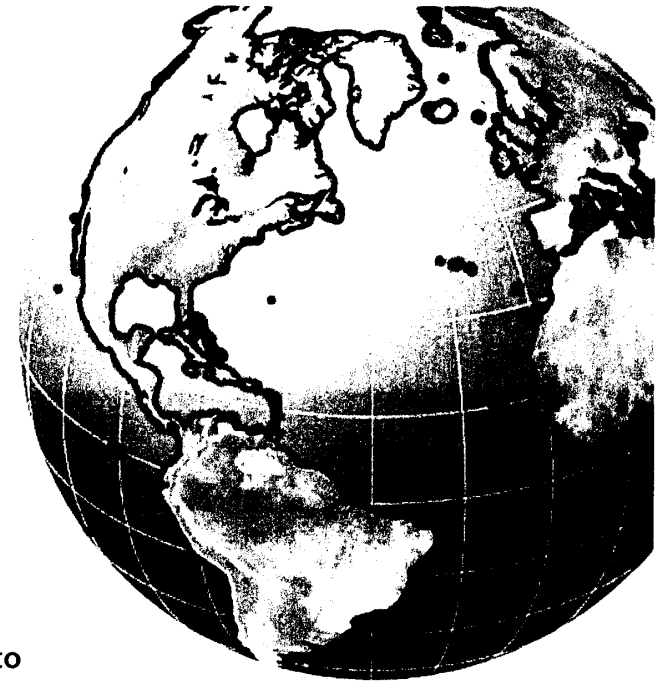
Claude Mathieu

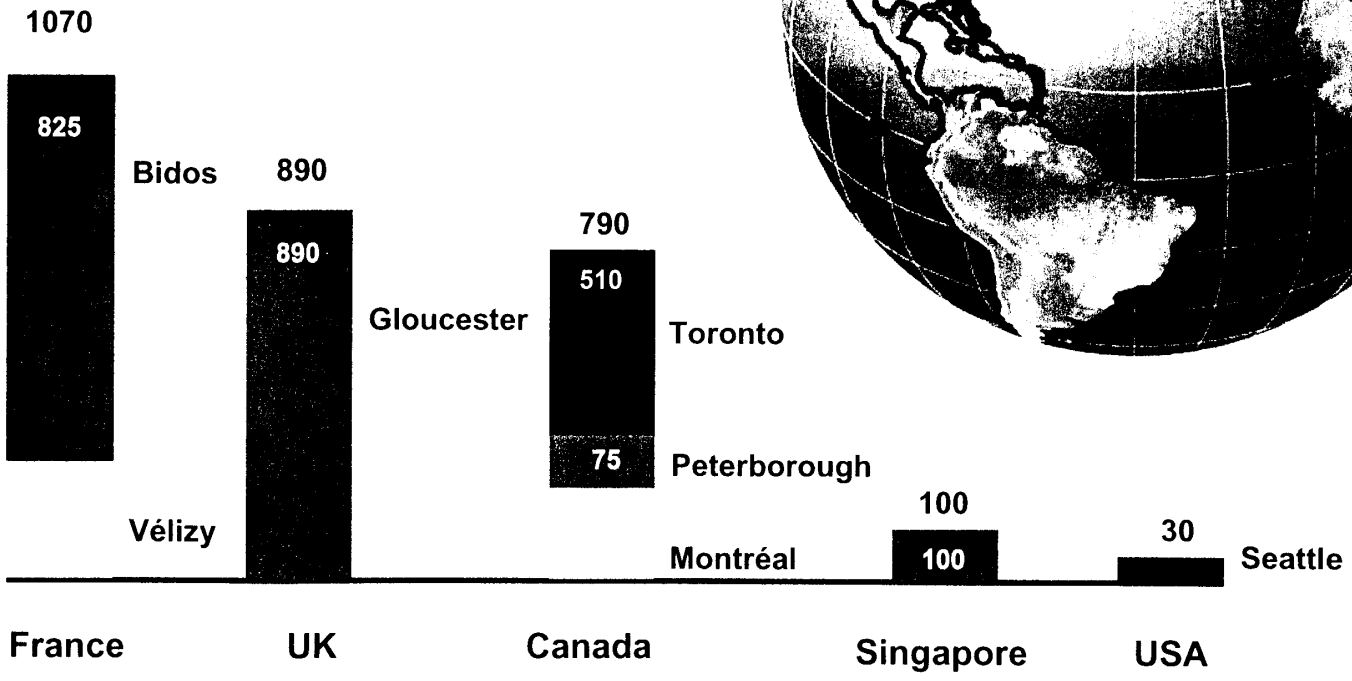
PUBLIC RELATIONS

François Roudier

A WORLDWIDE MANUFACTURER

2,900 employees

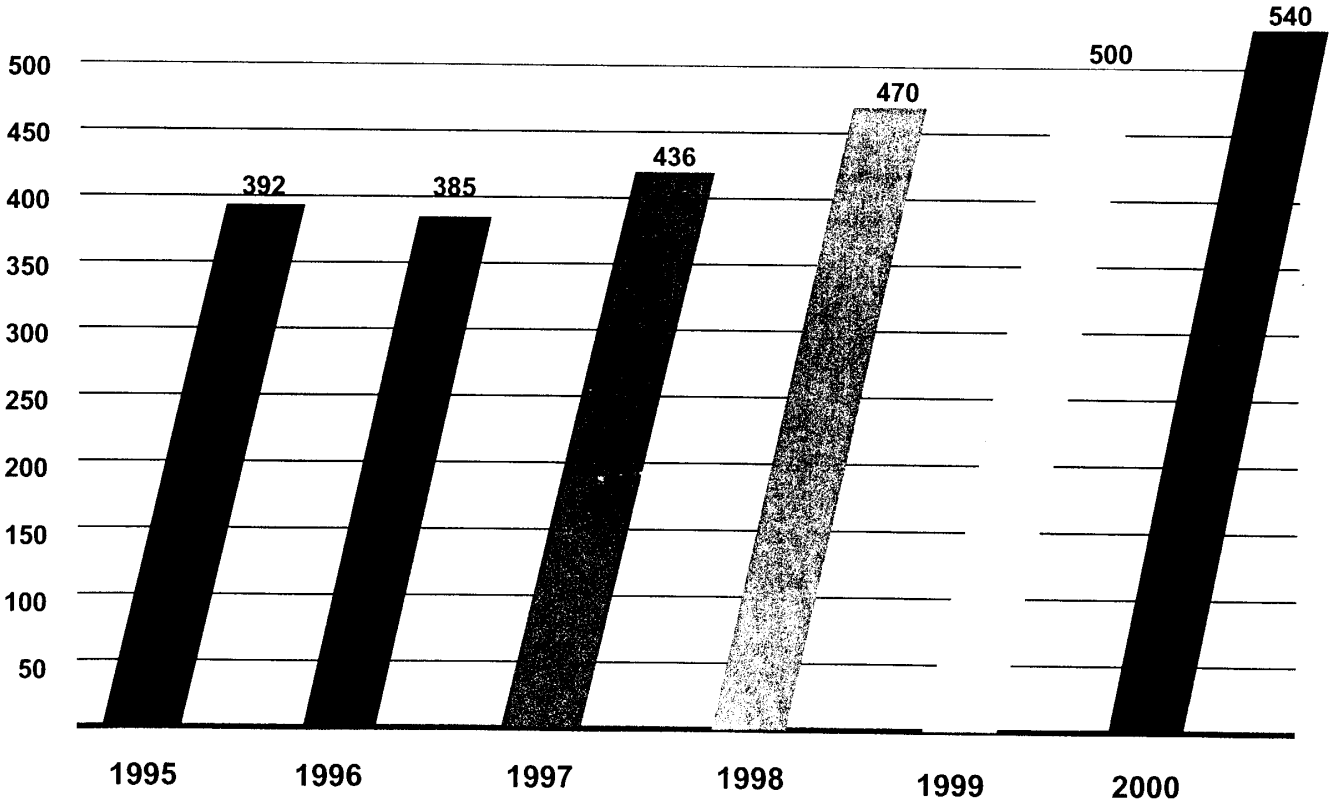




THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
Snecma group

SALES EVOLUTION: 1995-2000



THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
snecma group

MESSIER-DOWTY INTERNATIONAL BOARD

Chairman:

Louis Le Portz, Chairman & CEO, Messier-Dowty International

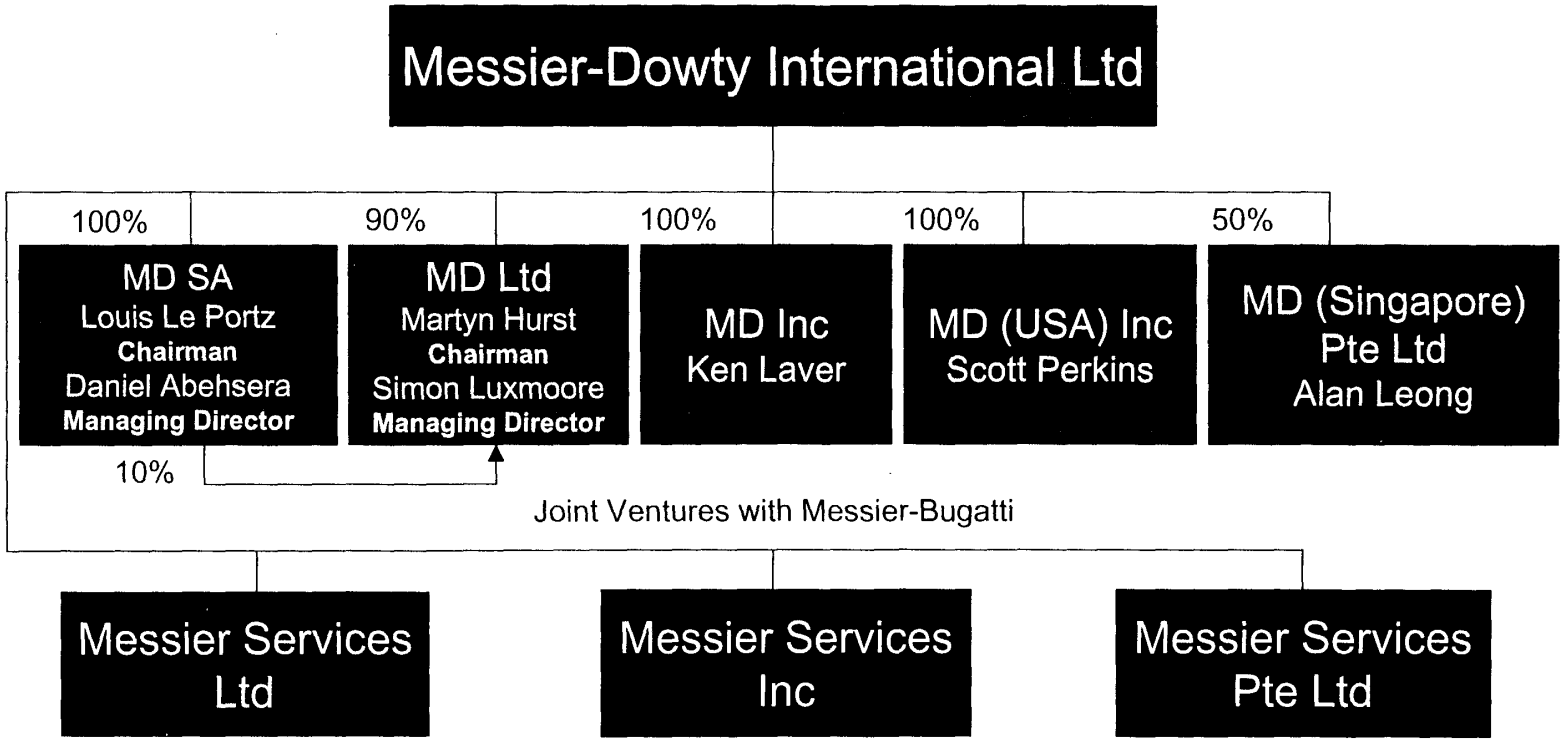
Members:

Jean Paul Béchat, Chairman & CEO, Snecma
John P. Capellupo, President, McDonnell Douglas Aerospace (Rtd)
Yves Imbert, Snecma Group Senior Vice-President, Equipment Branch
Sydney Gillibrand, Chairman, AMEC Plc
Michel Harvey, UK Director, Snecma (Ret)
Yves Leclère, Chairman & CEO, Messier-Bugatti
General Jean Rannou, Chief of Staff, French Air Force (Ret)
Sir Donald Spiers, Chairman, Meggitt Plc and European Helicopter Industries Ltd

Secretary:

Gérard Joucla, Director of Legal Affairs, Messier-Dowty

Messier-Dowty Legal Organization



THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
sneema group

AIRBUS BUSINESS UNIT

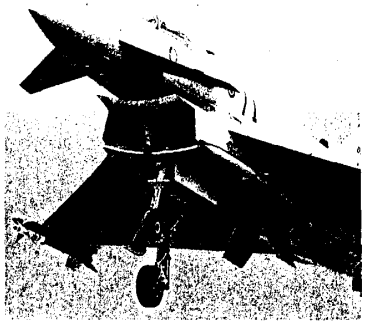
A300/A310
A319/A320/A321
A330/A340
A340-500/600
A380

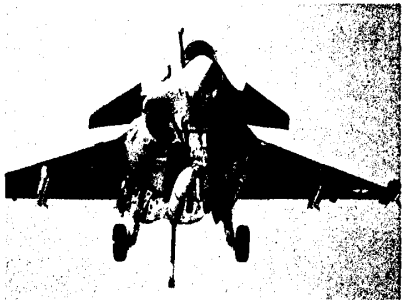
THE GLOBAL LANDING GEAR COMPANY

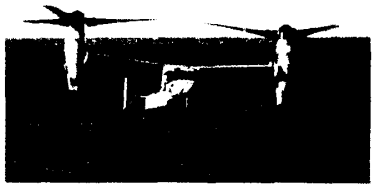
Messier-Dowty
Snecma group

BOEING AND MILITARY BUSINESS UNIT

EADS
AGUSTA/WESTLAND
AGUSTA/SIAI MARCHETTI
ALENIA / AERMACCHI / EMBRAER
BAE SYSTEMS
BELL / BOEING
BOEING
CASA
DASSAULT AVIATION
DENEL
EUROCOPTER
EUROFIGHTER
KAMAN
KAI
PANAVIA
SEPECAT







THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
snecma group

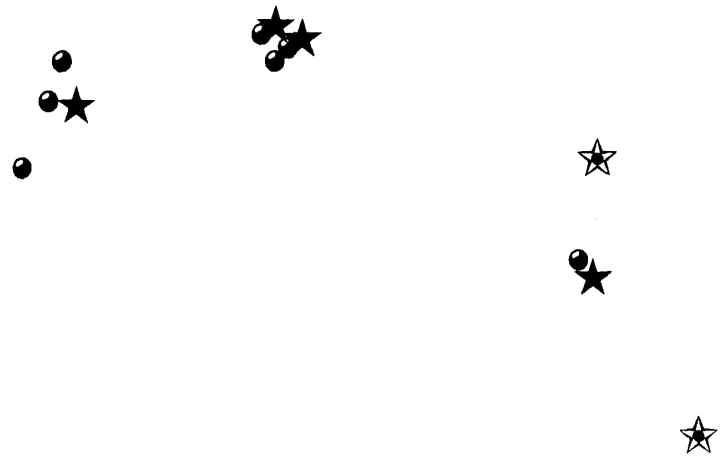
BUSINESS AND REGIONAL AIRCRAFT BUSINESS UNIT

ATR
AVRO
BELL / AGUSTA
BOMBARDIER
CASA
CASA/IPTN
DASSAULT FALCON
FAIRCHILD DORNIER
EMBRAER
FOKKER
PIAGGIO
RAYTHEON
SOCATA

THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
Snecma group

MESSIER SERVICES GLOBAL SUPPORT NETWORK LOCATIONS



Messier Services Facilities

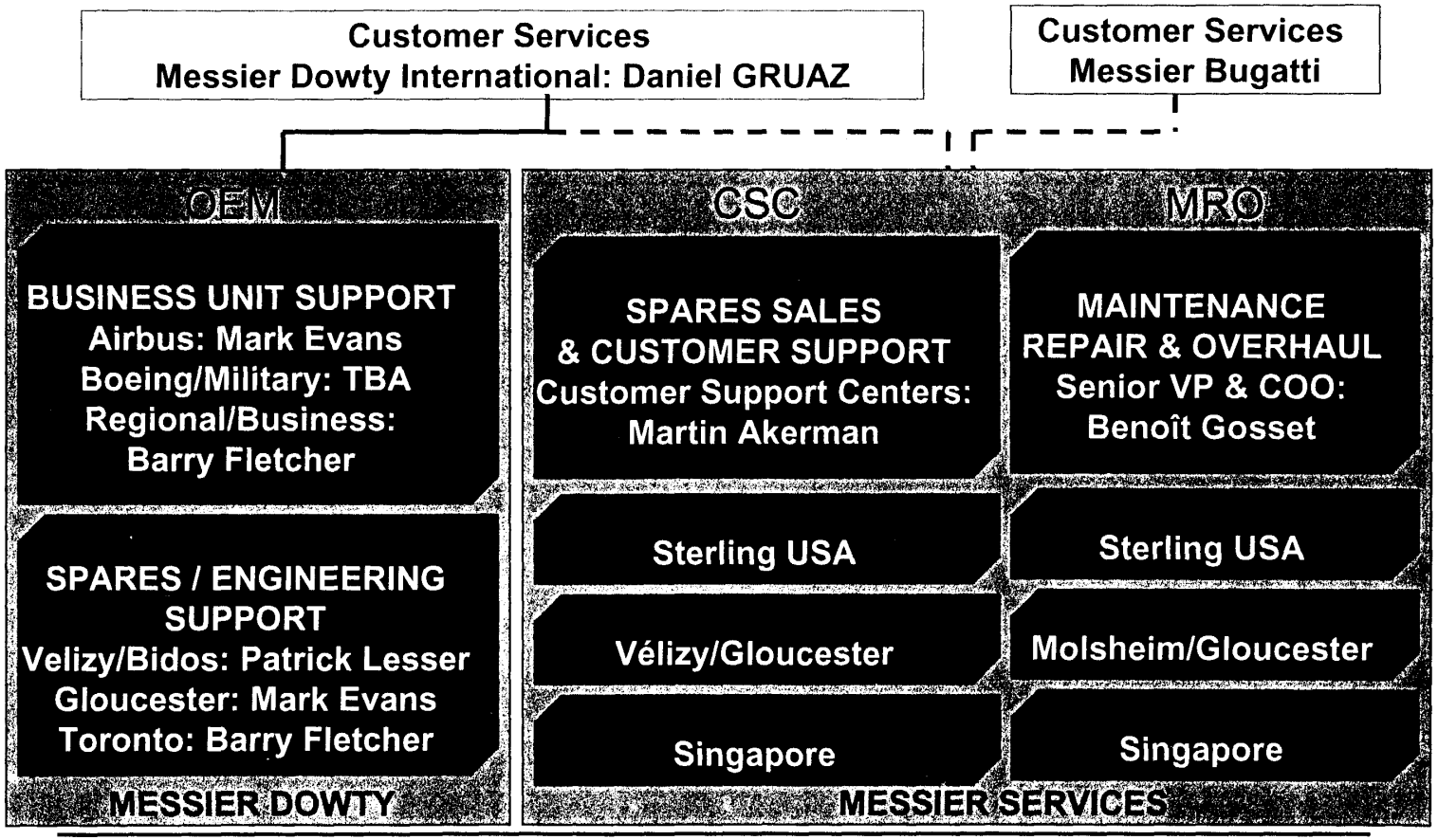
USA: Sterling, Virginia
USA: A-PRO, Deerfield, Florida
Canada: Toronto
France: Vélizy and Molsheim
France: HYDREP - Dinard
UK: Gloucester
Singapore: Loyang
Singapore: S-PRO
China: Beijing
Australia: Melbourne

● **Repair & Overhaul Shops**
★ **Customer Support Centers**
☆ **Technical Support Offices**

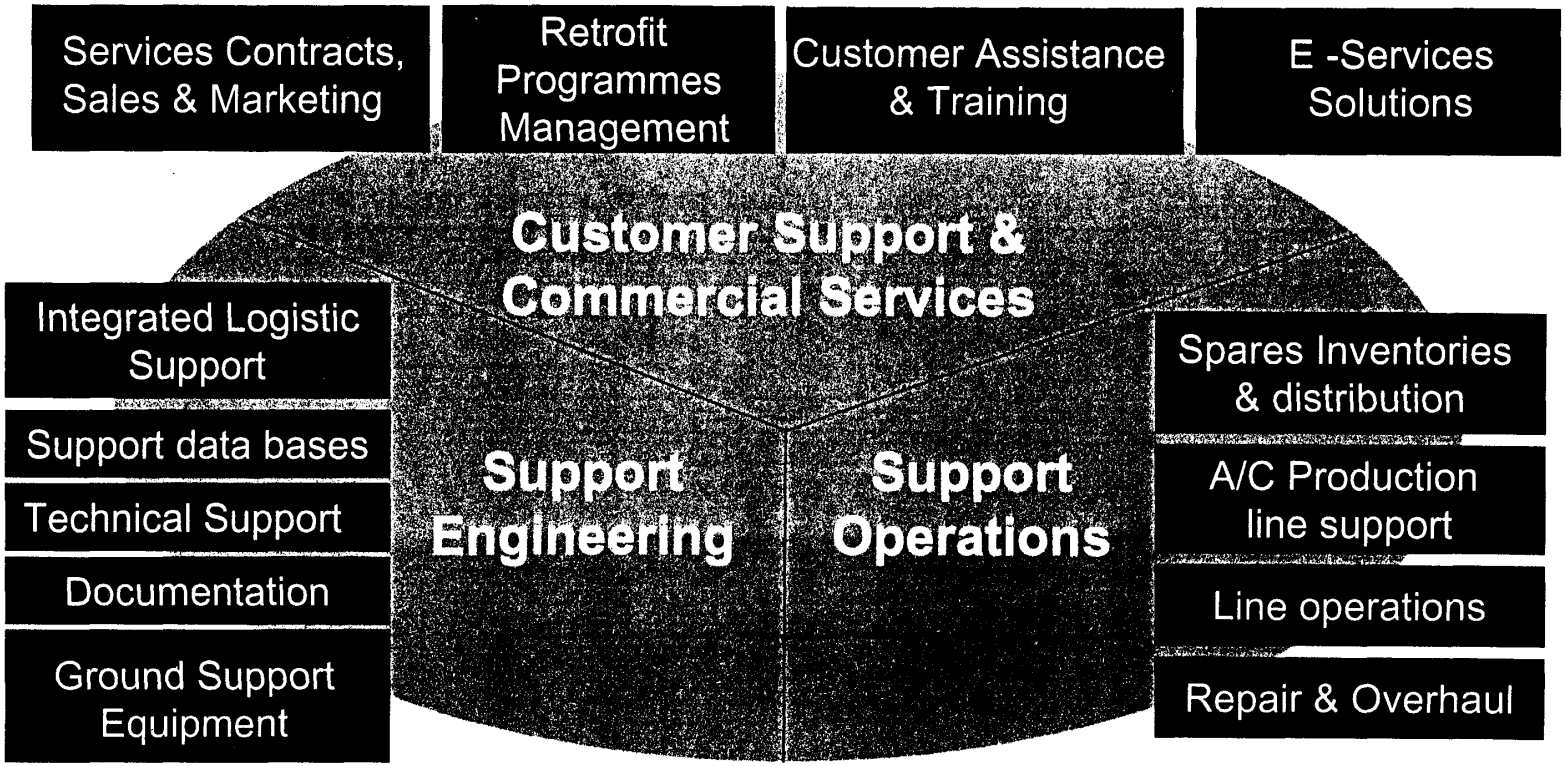
THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
snecma group

CUSTOMER SERVICE ORGANIZATION



CUSTOMER SERVICES MAIN FUNCTIONS



THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
snecma group

COMPETITIVE ADVANTAGES

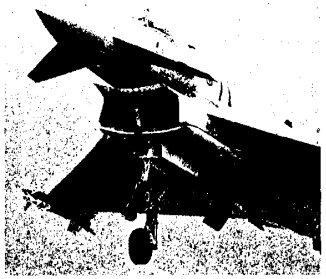
Complete landing gear system expertise

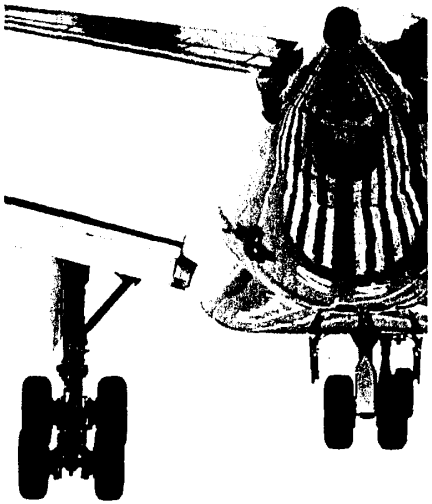
Broad and diversified program experience

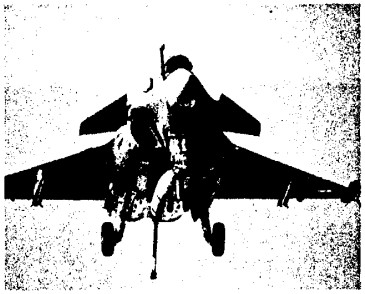
Advanced engineering capability

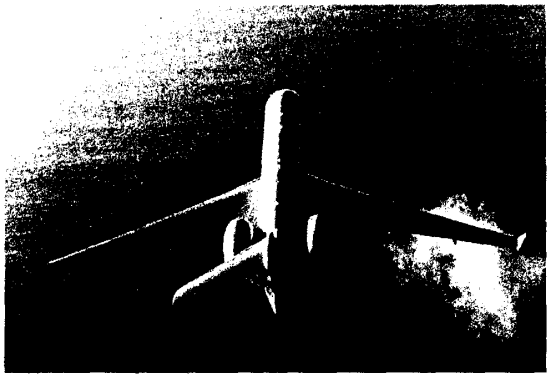
Worldwide customer support capability

OVER 30,000 TAKEOFFS ...









... OVER 30,000 LANDINGS PER DAY

THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
snecma group

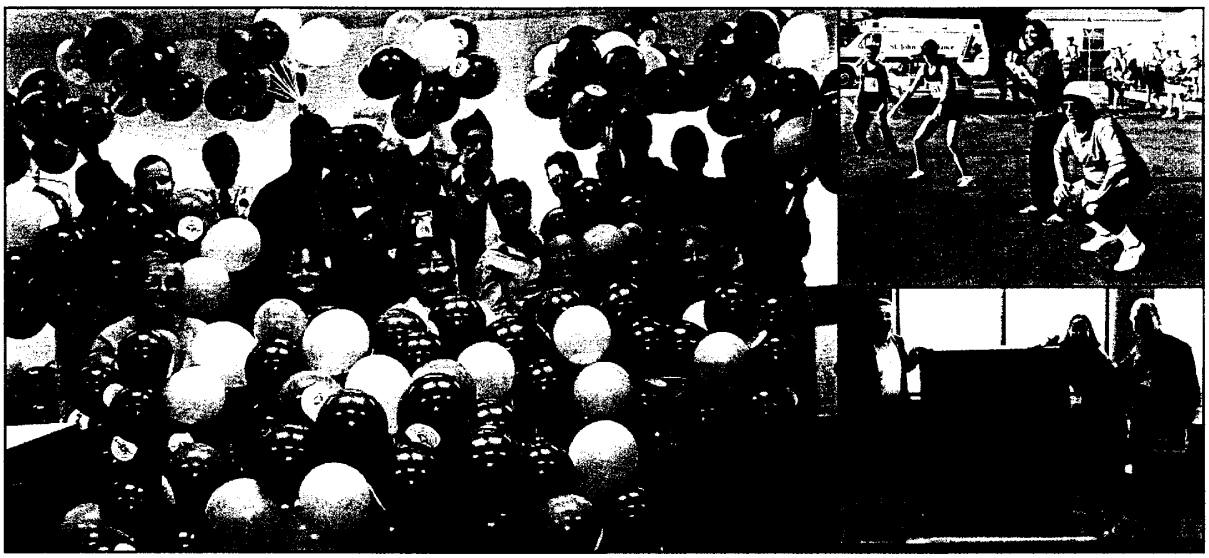
TOUCHDOWN

THE GLOBAL LANDING GEAR COMPANY

Messier-Dowty
SAFRAN group

TORONTO

Messier-Dowty Newsletter | Fall 2001 - Issue 20



Messier-Dowty employees get involved! Clockwise from left: The United Way committee 2001. Neil O'Brien cheers on fellow runners in the UW Power Challenge. Neil raised the most money at $540, and won a television set! Ken Laver and Barry Wohl with Shirley Gonsalves - winner of the draw for the 53" television set.

At Messier-Dowty, we care!

At Messier-Dowty we care. Employees and the Company are continually reaching out to the community with various fundraising efforts.

Rose Ann Downie raised over $300 from employees for the Red Cross for the victims of the World Trade Center tragedy on September 11th. That amount was matched by the Company.

Rob Chappell has for six years in a row run10 km at the Terry Fox Run in Whitby. Due to the generous support of many people at Messier-Dowty, he was able to reach his goal of $1000.00 in pledges. In fact, over the past several years, the generosity of many people at Messier-Dowty have played a big part in helping him raise over $4,000.

There are many other employees who throughout the year raise money for various efforts and we thank and congratulate them.

Our United Way Campaign - Over $38,000 raised!

We have also just completed our 2001 United Way Campaign. We would like to thank all those who gave pledges for generously supporting a good cause. Including payroll deduction pledges, monies raised from selling raffle tickets (including the big screen tv), flying airplane contest, hula hoop contest, baked goods, etc., and a generous corporate contribution, we raised $38,690! Congratulations, and thanks for your generous support!

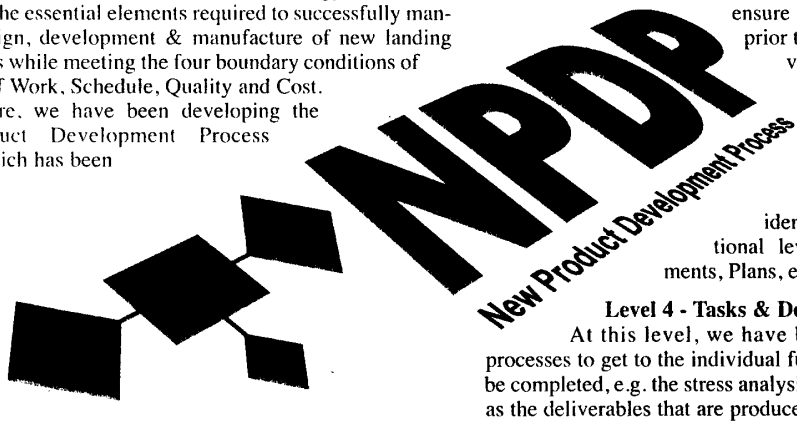
The United Way Committee is always looking for volunteers with fresh faces, new ideas, and lots of hot air (for the Balloon Bust Blow-Up!) If you'd like to help out with next October's campaign, please speak to any of the following current committee members: Angela D'Angelo, Rob Blair, Sukhi Chana, Lisa Dougherty, John Dorsey, Al Gallimore, Shirley Gonsalves, Dale McIntosh, Jeaninne Middleton, Neil O'Brien, Mark Olan, Leonard Swartz, Mark Honsberger, Brian Farrar, Yvonne Vindigni or Lisa Bailey.

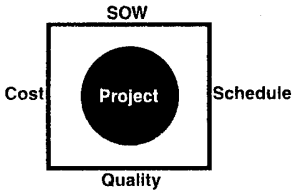
What is NPDP and why do we need it?

With the increasing market demand for complete Landing Gear Systems, reduction in development time scales and the need to work jointly with the other MD sites in France and England, we need to have a common process.

The objective is to establish a methodology that would encompass the essential elements required to successfully manage the design, development & manufacture of new landing gear systems while meeting the four boundary conditions of Statement of Work, Schedule, Quality and Cost.

Therefore, we have been developing the New Product Development Process (NPDP), which has been launched as a Snecma initiative under Action V. This article is aimed at providing a taste of NPDP with the aim of providing more detail through the intranet in the coming months.





While we have fancy logos and diagrams to publicise and explain NPDP, the concept itself is simple. It is a formalisation of a methodology for a consistent approach.

Firstly, identify all the internal and external deliverables. These can be anything from a drawing or layout to analysis reports and compliance statements. Then define the tasks needed to complete these deliverables. Most importantly, we place checkpoints at strategic points in the process to ensure accuracy of the data and robustness of the product.

The NPDP methodology comprises of three elements and provides a logical connection between them. These elements are:

1. **Process Decomposition**
2. **Work Breakdown Structure (WBS)**
3. **Integrated Product Teams (IPT)**

The Process Decomposition is a way for us to take the top level multifunctional activity, such as design & develop a landing gear system and break it down until we get a single functional activity such as stress analysis of shock strut piston. This is done using four levels as follows:

Level 1 - Enterprise Process

This consists of four top-level processes that cover the four stages of the Program Life Cycle, namely Acquire Business, Product Development Cycle, Build & Deliver Product and Provide Product in Service Support. Our current focus is on the Product Development Cycle.

Level 2 - 1st Stage Process Decomposition

At this level we breakdown each of the above processes and align them to the milestones or gates such as Preliminary Design Review, etc. Some of the sub-processes span these gates. We describe the period between these gates as phases. We call them gates to signify that we can not proceed to the next phase without closure we use checklists to ensure completeness of our work prior to reviews. The review provides formal approval to proceed to the next phase.

Level 3 - 2nd Stage Process Decomposition

This is an intermediate level where we begin to identify tasks at a multi-functional level, e.g. Define Requirements, Plans, etc.

Level 4 - Tasks & Deliverables

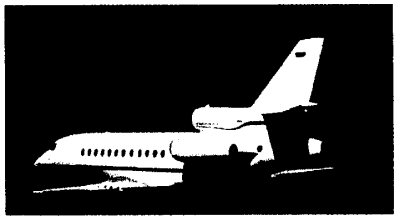
At this level, we have broken down each of the processes to get to the individual functional tasks that need to be completed, e.g. the stress analysis mentioned above, as well as the deliverables that are produced, e.g. Shock Strut Piston Drawing.

The NPDP methodology is enabled through the use of the WBS and IPTs. The WBS captures all the deliverables, tasks & checkpoints, in a generic form, that result from the Level 4 process decomposition. When durations and the dependencies are applied to these, it forms the Program Schedule with which we are able to monitor and manage the Program.

IPTs are multi-functional teams that are defined as a result of the Level 3 process decomposition. These teams are responsible for the deliverables and the tasks required to produce these deliverables.

What do we expect to gain through NPDP?

The benefits that we foresee are a standardised approach to design and development of new landing gear systems, an efficient development cycle, improved product quality and flexibility to move people from program to program. It provides a framework to apply continuous improvement through the application of lessons learned at each phase of the program. The short-term goal is to be 'Best in Class' and long term is to be 'World Class'



How will NPDP affect me?

You will need to work in and as a team. The strength of IPTs is in the expertise that each member brings to that team, enabling better informed decisions to be made. Each team's roles and responsibilities are discussed and defined up front; and so it will make it easier to do your individual tasks.

Where are we presently?

The complete framework is in place. Currently our attention is on implementing NPDP on the Dassault Falcon FNX program. Following that we will complete the manual and hold training sessions to enable formalization and institutionalization of the process.

Written by the NPDP Implementation Team

Creative in Peterborough

By Richard Elmsley and Jason Tavner

In issue 18 of Touchdown, Messier-Dowty Electronics reported working on the design of a new Electronic Engine Controller (EEC) for the Pratt and Whitney PW6XX series of general aviation engines. Since that time, excitement within the industry has been growing at a phenomenal rate!

The new EEC concept was entered in the Snecma creativity contest and won the first round of competition for the engineering category. The creativity team from Montreal won the second round of competition (the Messier-Dowty level) with their excellent new hard plating process. Given the success at the competition, the EEC has been forwarded to Snecma to represent Messier-Dowty in the patent category in the final level of competition.

M-DE's Creativity Team and key supporters. Front Row (left to right): Peter Vos, Jason Tavner, Carlos Teani, Robert Tallman Back Row (left to right): Rick Elmsley, George Novacek, Ken Erskine, Andrew McDougall, Harley Payne

The full potential of the EEC concept is becoming even more apparent as the design progresses. Based on the modular design and flexible operating system of the controller, the EEC is well suited for use in other aircraft systems including nosewheel steering, landing gear control, and brake control. Messier-Dowty Electronics has already been awarded the contract for the combined Falcon FNX nosewheel steering/proximity system controller for the Falcon FNX based on the EEC design.

The EEC operating system consists of both hardware and software. The system provides all signal conditioning, data acquisition, and data output functions for the application software. The hardware is split into functional blocks that provide generic interfaces for the majority of the electronic sensors encountered in the aerospace industry. These hardware blocks can be populated on a generic PCB as required and modified by changing component values. This eliminates costly PCB layout and development time by leaving approximately 90% of the hardware unchanged across projects. In order to meet customer requirements on future products the majority of modifications are handled by writing new application software and updating system limits in the operating system software.

The development of the EEC will provide many advantages to Messier-Dowty Electronics and Snecma as a whole. The final product provides an excellent opportunity for new business and growth. The modular design and versatile operating system will decrease future development timelines without sacrificing functionality, safety, or reliability. A saving of one million dollars per program is estimated after the initial development of the EEC.

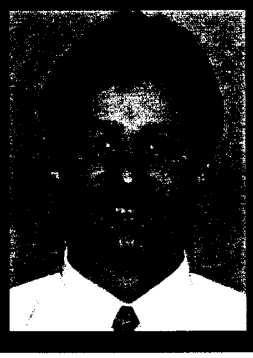
The development team has ensured coverage from all internal and external customers. Within M-DE all designed circuits are being reviewed and approved by engineering, purchasing, and manufacturing. Snecma have provided a wealth of experience and lessons learned from their own EEC programs. Other inputs have come directly from our customers to ensure all of their requirements are met. With all of the parties working as a unified team the success of the program is guaranteed.

In addition to the design of the final product, this project also lays the groundwork for how Snecma works as a global team in the aerospace industry. The ability to draw on our own experience and the experience of Snecma and our partners allows us to reach new levels of technical excellence.

Health & Safety Update

will return in the next issue of

TOUCHDOWN

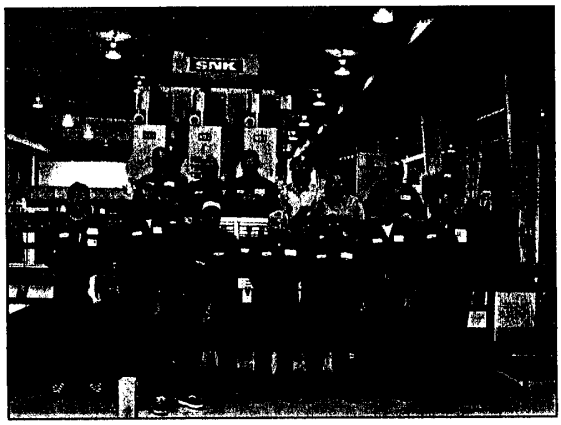


Cell Two - Production

By Mary Drane

The Cell Two production team consists of eighteen machinists, two inspectors, one manufacturing engineer, a cell planner and cell leader.

The main parts produced in Cell Two production area are the shock absorbers for RJ, 604, Global and Hawker. Twelve varieties of pins are also produced on the cell two machines. A few new machines are part of the Cell now with the addition of the Gap Bed Lathe, Tacchi and Deep Hole Drilling Machine. The grinding department is also a part of Cell Two.

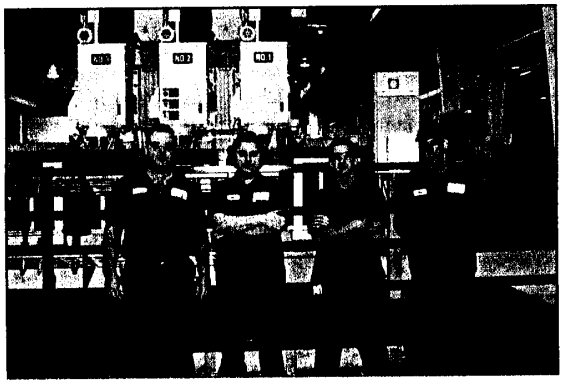


Cell Two Day Shift – From Left to Right: Front Row: John McFarlane, Mike Scott, Charles Millsom, Rick Loveless, Jack Talent, Ken Sanicharan, Larry MacArthur, Don Riley Back Row: Stephen Procter, Peter Lee, David Swerdleger, Mary Drane, Monique Gibsen, Peter Ruddy.

People Profile

The Shock Cell is the first Cell within Messier-Dowty Inc. that has implemented lean manufacturing and began using a pull system instead of an MRP based scheduling system. The pull system is very simple. The cell runs on a two loop system. The first loop, taking approximately four weeks, includes the manufacture of the parts up until they return from heat treat. After heat treat, they are put into a holding area called the "supermarket". The second loop consists of all the machining and processing that takes place after heat treat. This takes about eight weeks.

Main Stores keeps a small inventory of shocks. When a batch of three parts has been consumed, the storesperson issues a signal (in the form of a kanban card) back to the machine shop. When the card arrives from stores, the machinists in the cell pull a batch of parts from the supermarket and begin a new batch into the second loop. This batch replaces what was used in assembly.



Cell Two Night Shift - From Left to Right: Mike Gatenby , Neil Kent, Ryan Beatty, Wes Snellings

The lead time for shocks is normally twelve weeks but by bringing the signal from main stores back to the supermarket area, the lead time is essentially reduced to eight weeks. If main stores has a varying demand either up or down, the number and type of cards released to the machine shop will vary in the same manner.

Machines run on a first in first out basis. When the queue spots are full at a machine, machinists will stop sending work there. Many of the machinists are skilled to work on a variety of work centres so that they can best flow the work through the cell.

United Way Entertainment Book

$33 each ($15 goes to the United Way)

Good for the Greater Toronto Area Until November 2002. Thousands of Dollars Worth of Savings including Dining, Entertainment, Hotels, Sports, etc.

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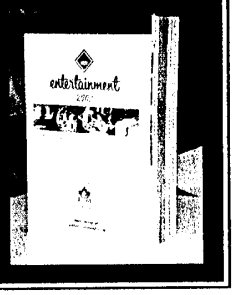
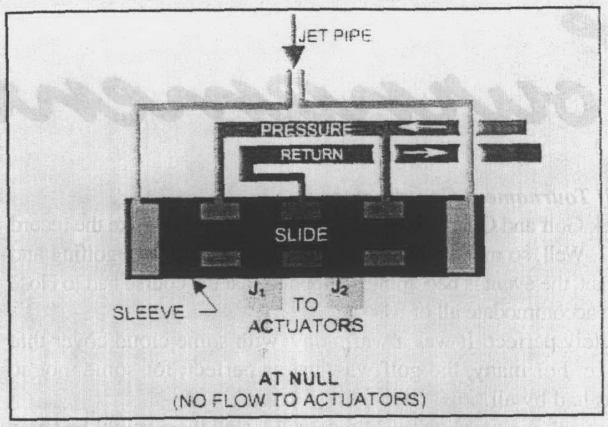
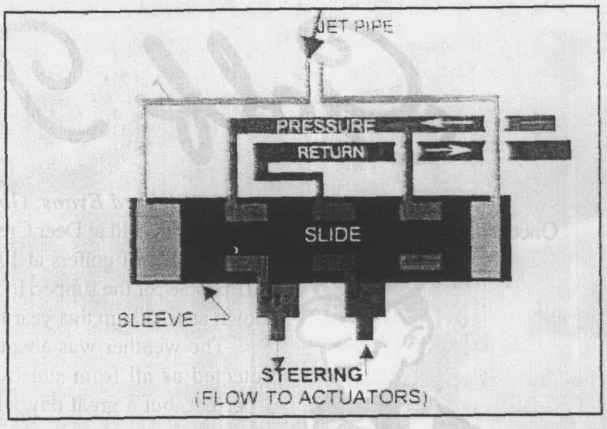
- Casey's Bar & Grill
- Nickels
- Shopsy's
- Old Spaghetti Factory
- KFC
- Baskin & Robbins
- Pizza Pizza
- Pharma Plus
- Indigo
- Blue Jays
- Golfing
- The National Ballet
- The ROM

On sale now at Human Resources







Landing Gear 101
Global Express Steering Control

by Brian Farrar

The four major players in the Steering Control System are the Handwheel, the Steering Actuators, the Steering Control Unit (SCU) and an Electro-Hydraulic Servo Valve (EHSV).

The handwheel is connected to a Rotary Variable Differential Transducer (RVDT). This RVDT transmits an electrical signal to the SCU. The actual signal depends on how far the RVDT is rotated by the handwheel.

There are two steering actuators which work together to steer the axle of the nose gear. Each steering actuator includes a Linear Variable Differential Transducer (LVDT) which lengthens or shortens as the actuator extends and retracts. Each LVDT transmits an electrical signal to the SCU. The actual signal depends on how far the LVDT is extended (like the RVDT, but the LVDT moves in a line (linearly) rather than around (rotary). The SCU constantly compares the signal from the handwheel's RVDT to the signal from the steering actuator's LVDTs. The SCU likes these signals to be the same.

The EHSV includes a slide and sleeve assembly, and a thing called a jet pipe. The slide moves inside the sleeve. When the slide is moved to one end of the sleeve, it allows hydraulic fluid to flow from the hydraulic pump, through the Port J1 to the steering actuators to turn the axle to the left. The fluid that is displaced from the steering actuators returns through the Port J2 to go back to the pump's reservoir. When the slide is moved to the other end of the sleeve, it allows hydraulic fluid to flow from the hydraulic pump through Port J2 to the steering actuators to turn the axle to the right. (Like that shower knob you pull to send the water to either the faucet or the showerhead.) The fluid that is displaced from the steering actuators returns through the Port J1 to go back to the pump's reservoir

The flow of hydraulic fluid is blocked off from the actuators when the slide is centered in the sleeve. This is called the 'Null' position.

The position of the slide is controlled by the jet pipe. The jet pipe sprays a small jet of hydraulic fluid at two holes. One hole goes to one end of the sleeve, and the other hole goes to the other end of the sleeve. When the jet pipe is centered over both holes an equal amount of fluid goes down each hole and hits each end of the slide causing the slide to centre inside the sleeve. This is the 'Null' position. If the jet pipe moves one way, then the jet will only hit one hole, causing the slide to move. The direction of the jet is controlled by an electrical signal sent from (you've guessed it) the SCU. (Do you see how this is all falling into place yet?)

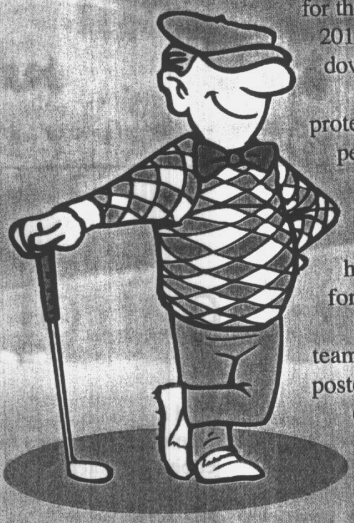
So, (deep breath) ...when the pilot turns the handwheel, the signal from the RVDT changes. The SCU compares the RVDT's signal to the signal from the LVDT and notices that they are now different. The SCU always likes to have these two signals the same; so, it sends an electrical signal to the jet pipe. The jet pipe moves and directs the jet over one hole which moves the slide. As the slide moves it allows hydraulic fluid to flow into the steering actuators. The steering actuators move to turn the axle. As the actuators move, the LVDTs inside them also move which changes the signal they transmit to the SCU. When the new signal from the LVDTs eventually matches the signal from the Handwheel's RVDT, the SCU is happy again and sends an electrical signal to the jet pipe to return to the Null position. This redirects the jet across both holes, and the slide returns to its centered position, cutting off the fluid flow to the steering actuators.

The handwheel is spring loaded to always return to the centre. When the pilot is happy with the direction the aircraft is facing, he can release the handwheel. The handwheel returns to the centre, but now there is, again, a difference between the signal from the RVDT and the signal from the LVDTs. The SCU always likes to have these two signals the same, so, it sends an electrical signal back to the jet pipe to re-direct the jet pipe the other way to allow hydraulic fluid into the steering actuators ....

Golf Tournament

By Richard Evans, Golf Tournament Coordinator

Once again the annual golf tournament was held at Deer Creek Golf and Country Club in Ajax. Last year we broke the record for the number of golfers at 177. Well, so much for records. This year we had 193 golfing and 201 people for the supper. In fact, the event is becoming so popular that the course had to close down at 10:20 am this year to accommodate all of us.



The weather was absolutely perfect. It was a warm day, with some cloud cover that protected us all from sunstroke. For many, the golf was just as perfect, for some, not so perfect, but a great day was had by all.

For weeks up to the event, the word on the 'street' suggested there might be some new winners this year. Many teams had high hopes of winning, and the announcement that Fran Stilwell had dropped out of one of the 'Reigning Champions' teams, had everyone rubbing their hands. Bruce, Tim, David and Rick Lavigne (who subbed for Fran) had not played too much golf this year, so the 'game was on'.

At the end of the day, many familiar names were on the Leader-Board. Jack Talent's team, the other of last year's champions, came in with a score of –10. Iain Dunn's team also posted a –10 score. Bruce, Tim, David and Rick were there at the end with a –11 score (guess they didn't miss Fran too much!), but at the final tally we had a new set of champions. Congratulations to Peter Bhavra's team which came in with a tremendous score of –12. Peter, Trevor Lewin, Harjit Singh (Peter's Sister) and Ranjit Singh took home the day's honors. A teary eyed Trevor was overheard saying, "This is the first time in twenty years I have ever won anything at this tourney". Well Done Champions!

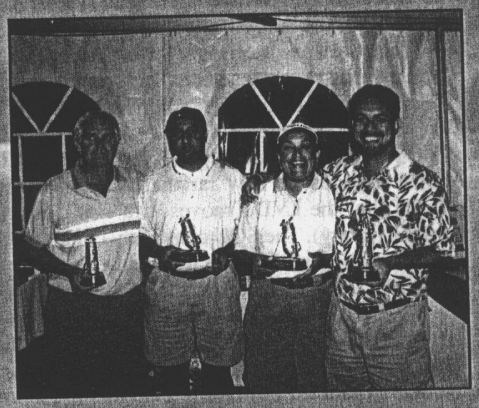
WINNER'S CIRCLE

Champions at a score of –12: (Tied)
Team 18: *Peter Bhavra, Trevor Lewin, Harjit Singh, and Ranjit Singh*

Most Honest Team at a score of +36:
Team 8: *Polly Harris, Bev Windle, Monica Kavanagh, and Melody Reid.*

Men's Longest Drive: *Barry Baker*
Ladies' Longest Drive: *Carol Wilson*
Men's Closest to the Pin: *Derek Bond*
Ladies' Closest to the Pin: *Vivian Ilott*
Putting Competition:
First Place: *Scott Radcliff*
Second Place: *Alan Henry*
Third Place: *Harjit Singh*

"Congratulations to all our Winners"



The 'Champions'
Left to right: Trevor Lewin, Peter Bhavra, Harjit Singh and Ranjit Singh.

The supper was again excellent. We had over 200 seated and the steak was cooked to perfection. The prize table was full, and every golfer went home with a gift. We collected over $1200 for the United Way with proceeds from the Raffle and Silent Auction. Thanks to all who contributed.

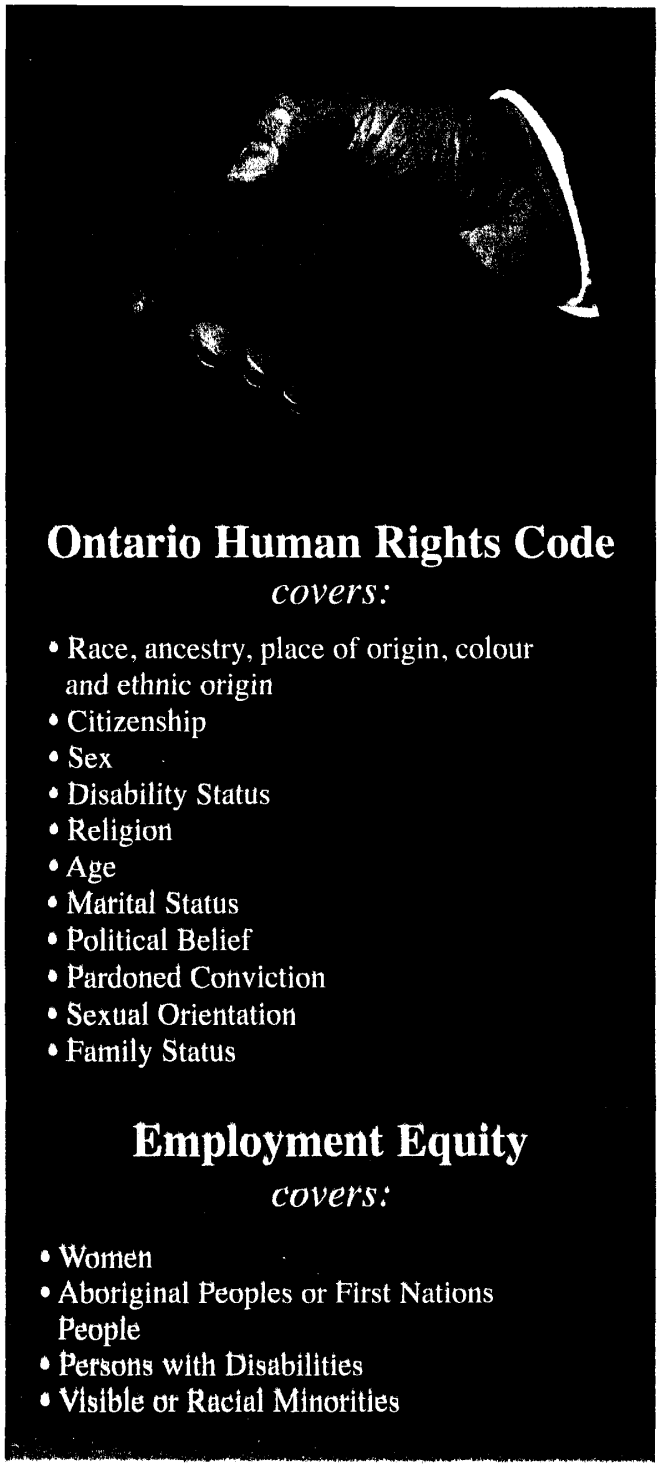
I have to say thank you to all those who attended, as you are the ones who make these events a success. Special thanks also to the following: Moe Morgan on Registration, Keith Sears for assisting with the putting, Vikki and Pat, and Louise and Mike, for organizing the raffle, and Lisa Bailey, for her help with the contribution letters. I have to say a special thanks to my son Chris. Without his help with the gifts, the putting, and the photos, the day would not have been such a great success. 'Thank you all'.

2001 - What a day!

Join us next year for another great day!

The Scoop on Employment Equity

by Lisa Bailey



In order to fully appreciate Employment Equity we must first have a good understanding of the Ontario Human Rights Code.

The Ontario Human Rights Code was designed to recognize the dignity and worth of every person and was established to protect the rights of all Ontarians. The Ontario Human Rights Code will always exist because it protects everyone, and over time the disadvantaged groups may change.

Employment Equity is a special program under the Ontario Human Rights Code. It was designed to protect the employment rights of four designated categories.

They have been chosen because statistically it can be seen that these groups as a whole have been disadvantaged in terms of higher levels of unemployment and underemployment, lower pay for equal qualifications, and lower participation in positions of authority.

Employment Equity is only intended to exist until there is no longer discrimination in the workplace for those four categories. The type of discrimination Employment Equity is most concerned with is not direct or intentional discrimination but systemic discrimination. Systemic discrimination is unintentional discrimination which occurs when there are barriers within an employment system i.e. if a workforce is predominantly white and they refer their friends who are also predominantly white this would be a barrier to having a workforce which is representative of the community. Employment Equity does not mean hiring unqualified people. It is simply an effort to ensure there are no barriers to employment for the four designated categories and that the workforce is representative of its geographical area. For this reason it is not reverse discrimination. There are many systems involved that can be affected including recruitment, hiring and promotion, training, work environment etc.

The Human Resources Department at Messier-Dowty is continually striving to ensure that barriers do not exist in the workplace and that all Employment Equity requirements are met.

upcoming events

Christmas Parties

Please join us for the
Adult's Christmas Party
on
Saturday, December 15th

Children's Christmas Party
on
Sunday, December 9th

SOCCER Summer 2001

By Mark Hopewell and Al Gallimore

Looking back at our season, like the game, it was a season of two halves. The first half was tough; we struggled with player injuries and availability (too much travel).

The second half, the Dowty team that won the Cup Championship last season showed up!

The bottom-line, we finished up well in the league and fell to a disappointing defeat in the Cup semi-final.

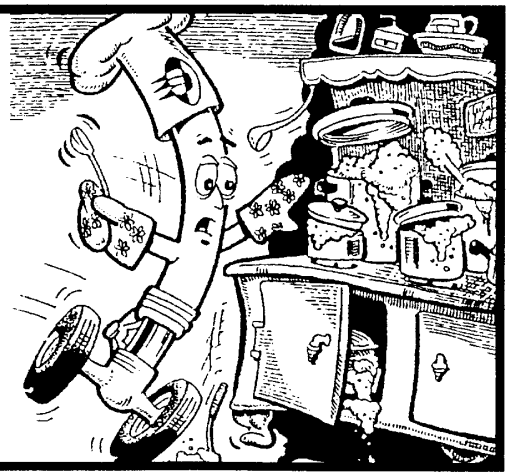
A big thank you to Barry Wohl and the generous support of Messier-Dowty, without which we would not have had the opportunity to play.

Looking to next season, we are hoping to enter two teams; under-40 (competitive) and over-40 (recreational). If there are players who would like to join the team and have played organized soccer, or an employee has a child or sibling who is interested, please see me or call me (ext. 1390) or Al Gallimore (ext. 1212).

Messier-Dowty Cookbooks

$10 each

100% goes to the United Way
On Sale in Human Resources



All At Once

by Robin Pollock

All at once I was ashamed of my humanity,

How could members of the human race perpetrate such a violation against innocent individuals?

All at once I was proud to be Canadian,

Bearing witness to the acts of kindness and compassion for which we should all be very proud,

All at once the talk of violence and retaliation numbed my sensibilities and thrust me into a conflict with my own beliefs,

All at once my humanness and those immutable truths washed back over me with soothing warmth and understanding.

All at once my own ignorance humbled and tempered my words and reactions to the onslaught of truths and half-truths invading my ears and eyes.

All at once the innocent laughter of a child brought me back to the reality of all those things most important in our lives,

All at once I feared that this same innocence was being ripped away from them by ignorance and bigotry,

All at once I found solace in the many words spoken by the most enlightened among us who are seeking to bring context and reference.

All at once it has begun, the seemingly never-ending cycle of violence,

All at once I pray that those truths that we hold so precious and are so fortunate to enjoy in this country hold true, and that these same truths are extended to all human beings throughout the world and that we can remain, must remain, a compassionate, educated and civil society.

All at once again I pray.

Did Your Life Change in September?

by John Hussey

I find it very difficult to write about anything humorous after the acts of terrorism that took place on September 11th.

That day changed the lives of all of us that live in the free world. It gave us a different view about ourselves and our fellow man. In New York, services in cathedrals and churches filled and emptied six times a day. The owner of a Manhattan tennis shoe store gave out running shoes to those running from burning towers. People stood in line to give blood, volunteers came out of nowhere to help in hospitals and at Ground Zero. Indeed the American people were different that week.

We cried for people we didn't even know, we sent money to families we had never seen, our focus shifted from the things we thought were important to us, to orphans, widows and the future of the world, we were all different that week.

Democrats or Republicans, it didn't matter, they worked and acted as one. All denominations prayed together, all skin colours were covered with the ashes from the burning towers. This is a different world than it was before September 11th, none of us were normal. Could this be a new way of life? Are we as free nations being reminded that the enemy is not each other? Does it take a disaster to make us act the way we should?

Perhaps the best response is to follow the example of Tom Burnett. He was a passenger on Flight 93 and minutes before the plane crashed into the fields of Pennsylvania he reached his wife by cell phone, "We are all going to die", he told her, "but there are three of us who are going to do something about it." Maybe it will motivate us to do something about it. Appreciate the friends and the good life we have that can be changed instantly by a tragedy.

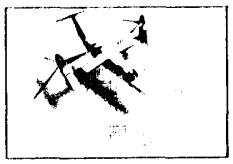
No terrorist attack or whatever else happens will ever take my sense of humour away from me, which was probably the only gift I was ever given, but for some reason I don't feel like laughing today.

By the way, it is still safer to fly than to drive with me to Montreal!

Preceeding articles are the words of the writers and were included in this edition to reflect on the tragic events of September 11th

Test Engineering Theory in Practice

By R. Kyle Schmidt, P.Eng.



Of all the tests that Test Engineering performs, drop testing is arguably the most exciting. Where else do you get to see the tire smoke, hear the noise, and feel the impact of our product going through its paces?

Drop testing, besides being exciting, has some of the most demanding requirements. Tests last only a few seconds, and in that time information about how the landing gear is performing must be collected and subsequently reviewed by Dynamics Engineers. To do this reliably, a data acquisition system that can collect information on each landing gear parameter at over 5000 times per second is used. This information can be immediately checked to verify that the drop met the specifications of the test procedure and the data can be sent via the network for analysis.

Currently in the drop test facility are the BA-609 nose and main landing gears. These drops are somewhat different than previous drop tests. For most tests, the landing gear is mounted directly under a fixed weight drop test carriage. This carriage slides in the tower and carries weights to simulate the mass of the aircraft that would be acting on the landing gear during a landing. For drop testing of tilt rotor aircraft, a second, sprung mass, needs to be incorporated into the drop test carriage. The mass and spring simulate the weight of the aircraft engines and the flexibility of the wing.

A drop test is performed by hoisting the drop test carriage and landing gear assembly above a ground reaction platform (an instrumented platform to measure landing forces). If required, a spin-up rig is used to rotate the tires (backwards -- to simulate the load path caused by spin-up during landing). When the wheels are spinning at the correct speed, the carriage is released into free fall. Gravity alone accelerates the carriage to the required landing velocity. The carriage descends and impacts the ground reaction platform. This is the moment everyone waits to see. The wheels come to a quick stop, often with a cloud of burned rubber smoke. The tires and the shock strut absorb the energy of the drop, and the carriage rebounds. After some time to cool, it is ready to go again. Depending on the test program, 40 to 100 drops are required. That is a lot of drops, but it's 40 to 100 times as much fun as one.

What's new in Peterborough!

By Diane Parsons

By the time you read this our 2001 United Way Campaign will be well underway. Let's continue the spirit that was generated last year, due in part to the enthusiasm of our in-house United Way Team members but mostly by your generous support. This year's team consists of Linda Humphries, Katherine Jordan, Diane Parsons, Warren Scott and George Vanin. With your continued support, here's to another successful year.

Congratulations go out to Rick Elmsley, Robert Tallman, Jason Tavner, Carlos Teani, Peter Vos, Andrew McDougall and Ken Erskine on winning the first selection process (between Ajax and Peterborough) in the "CREATIVITY CONTEST". They won for their project "New Generation Real Time Fail Safe Controller" as described in the article penned by Rick Elmsley and Jason Tavner in this issue of Touchdown. We are very proud of this MDE team and commend them on their collective efforts, which will inevitably help us compete for new business opportunities in the future. It is our hope that MDE employees will continue to combine their creative efforts.

Peterborough Update

During the first week of October we welcomed Jean-Paul Ebanga, Loic Nicolas, Jamil Dirani and Marc Liprandi from Snecma Control Systems headquarters in Villaroche, France. This executive team is helping provide support and guidance to MDE as we prepare to join the Snecma Control Systems family in January 2002. Of course you know this means that we all need to brush up on our high school French, and then some!

Christmas is fast approaching and our annual Dinner and Dance will be held on December 8th at Parkway Place. Please sign up and come out and have a good time.

In closing, welcome to all the new employees.

Managing Programs
Implementation Initiatives at M-D Toronto

Evolution - Transformation - Revolution - Processes -Policies - AMS (Advanced Management Solutions) - NPDP (New Product Development Process) - PDM (Product Data Management) - Central Servers .... to name a few.

by R. Lavigne

I am sure many of you have heard reference to these new buzzwords over the past few months. Well, they are more than just buzzwords; they are progressively becoming an integral part of our business practice.

Credit has to be given to our management who had the vision that we needed to manage our programs differently and more effectively. This vision empowered the functions within the organization to have a good hard look at how we manage programs and what it would take to re-establish our processes to become what is considered a world-class operation. It began with the recognition that Program Management as a function needed to make some fundamental changes. The long process of developing an architecture that truly supported the "management of programs" vision was soon underway. Not long after, the engineering function recognized the opportunity that they too needed to re-engineer their processes and practices to better suit the new breed of development programs. The most important realization we discovered was that changes to Program Management and Project Engineering were not to be the primary focus; it was the management of programs company wide! What we discovered was that a more robust and repeatable way of managing programs across all functions through an Integrated Product Team environment was of paramount importance.

Approximately two years later, we are at a stage where the foundation of creating a revamped architecture is essentially complete, and we now need to test drive that vision as we further develop the organization as a whole. With the vehicle tool-set of AMS, the Program Management Handbook, NPDP, PDM, and education & training programs, we expect to maximize our competitive edge and firmly benchmark our leadership as the Global Landing Gear Systems company. I invite you to stay current with updates, news and progress in our quest for world class integration and growth via the company Intranet Program Management web site.

From the Editor:

For those of us who have been in the aerospace industry for a number of years we recognize the trend of a periodic economic slowdown about every ten years. Other industries all around us have been slowing down in the past months and we have been anticipating a potential slowdown in aerospace.

The horrific impact of September 11th affected us firstly on an emotional level but unfortunately it has also had a serious impact on the aerospace industry. I am proud to be associated with a group of employees like yourselves who again demonstrated deep concern and feeling at this time. Your donations along with the Company's matching donation to help the families of those who lost their lives, and your observation of three minutes of silence in their remembrance reflect some of the values that make us a very strong team.

Times will be difficult in the short term but I have all the confidence that we will emerge a stronger team in order to maintain our position as the World's leading designer and manufacturer of landing gear systems.

B. Wohl

What's New With You?

Hello and welcome to the "What's New With You?" corner of Touchdown. Do you or someone in your area have news you would like to share with your co-workers? New baby? Wedding Bells?, special Anniversary or Birthday? Has someone new been hired in your department or has someone left? Please let me know and I'll make sure it gets into the next issue

Kathleen Wilkinson

A Warm Welcome to:

Brian Huber - Contract Services
Paul Fletcher - Peterborough
Ken Erskine - Peterborough
Paul Davies- Engineering
Ahmad Adili - Peterborough
Doug Deshevy - Machine Shop
Allen Chiu - R&O Fitting Shop
Chris Kim - R&O Fitting Shop
Michael Peart - Peterborough
Vijay Rajagopalan - Quality Assurance
Peter Todd - Test & Development
Troy Whitmore - Peterborough
Kevin Petch - Contract Services

New Baby

Sukhi Chana and his wife Malkit are the proud parents of a new baby girl! Gurleen Kaur was born on July 29th, 2001 weighing 8 lb. .5 oz.

Linda MacBurnie and her husband Tony are proud "first-time" grandparents! Hayden Anthony Malcolm Weir was born on September 13th, 2001 weighing 8 lb. 7 oz.

Congratulations and Best Wishes to Everyone!!

SERVICE RECOGNITION

Every employee with five or more years of service at M-D will be acknowledged in the issue corresponding with their anniversary date. (Peterborough employees are included and noted by (P).

3rd Quarter Anniversaries July - September

Name and Years of Service

Stilwell, Francis . .40
Rogers, Carole . . .35
Hawe, Bruce 24
Corrigan, John . . .23
Mason, John 23
Jones, Denise . . .22
Tang, Howard . . .22
Elmsley, Janet (P) .21
Krasevec, Frank . .21
Lavigne, Richard . .21
Lindsay, Richard . .21
McKinnon, Kim (P) 21
Ning, James 21
Perkin, Andy 21
Salt, Barrington . . .21
Yorke, Howard . . .21
Bond, Derek 20
Hawkins, Steve . . .20
Miller, Brian 20
Pope, Brian 20
Rae, Robin 20
Ruddy, Peter 20
Thomson, Bill 18
Finney, Brian 17

Barnes, Brenda . . .16
Fischer, Tom 16
Graham, Kevin . . .16
Jackson, David . . .16
McFarlane, John . .16
Peters, Carl 16
Blair, Robert 15
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James, Ronald 5
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Windrem, Beryl (P) .5
Woodhead, Mike . . .5

TOUCHDOWN
THE GLOBAL LANDING GEAR COMPANY Messier-Dowty
TORONTO

The Messier-Dowty (Toronto) Newsletter is published for the employees of Messier-Dowty, Toronto. We would appreciate correspondence or articles for submission which may be sent to the editor at:

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附件三

致動器引用規範

Messier-Dowty Specification List

ITEM	NO.	REVLTR	TITLE	NOTE
1	DCMP 126	H	MACHINING OF HIGH STRENGTH STEELS	
2	DCMP 127	B	NITRIDING OF ALLOY STEELS	
3	DCMP 128	NC	REMOVAL OF NITRIDE WHITE LAYER, PROCESS FOR.	
4	DCMP 129	K	ETCH INSPECTION FO GROUND OR MACHINED STEEL PARTS	
5	DCMP 130	L	HEAT TREATMENT OF LOW ALLOY STEELS	
6	DCMP 131	E	LOW HYDROGEN EMBRITTLEMENT BRUSH CADMIUM ELECTRODEPOSIT	
7	DCMP 132	NC	BRUSHSULPHURIC ANODIZING FOR PEPAIRING ANODIZING ON ALUMINUM PARTS	
8	DCMP 133	D	HIGH STRENGTH, STRESS CORROSION RESISTANT ALUMINUM ALLOY FORGINGS	
9	DCMP 134	F	HIGH STRENGTH LOW ALLOY STEEL DIE FORGINGS	
10	DCMP 135	K	IDENTIFICATION OF PARTS	
11	DCMP 136	H	SHOTPEENING OF METAL PARTS	
12	DCMP 138	H	THIN DENSE CHROMIUM PLATING	
13	DCMP 139	G	MACHINING OF ALUMINUM ALLOYS	
14	DCMP 140	G	INSPECTION REQUIREMENTS FOR PARTS MACHINED FOR LOW ALLOY STEEL BARS	
15	DCMP 141	D	PASSIVATION OF CORROSION RESISTANT STEEL	
16	DCMP 142	NC	SUPPLER APPROVAL REQUIREMENTS FOR NONDESTRUCTIVE TEST	
17	DCMP 143	G	BEARING INSTALLATION	
18	DCMP 144	H	BONDING OF METAL LABELS	
19	DCMP 146	C	MECHANICAL AND PHYSICAL PROPERTY REQUIREMENTSFOR PARTS HEAT TREATED TO 7075-T73XXX	
20	DCMP 148	NC	INSTALLATION AND EXTRACTION PROCEDURE FOR LEE PLUGS & HYDRAULIC INSERTS	
21	DCMP 149	M	INSTALLATION OF SLEEVES, BUSHINGS & BEARINGS	
22	DCMP 150	A	STRIPPING CADMIUM PLATING	
23	DCMP 152	O	PAINT INSTRUCTIONS	
24	DCMP 153	NC	INSTALLATION OF ELASTOMERIC SEALS	
25	DCMP 155			×8949-4 10619
26	DCMP 157			×8319-5
27	DCMP 161	C	INSPECTION OF GROUND CHROMIUM PLATED PARTS	
28	DCMP 162	A	ROTARY FLAP WHEEL SHOT PEENING	
29	DCMP 163	C	CONTROL REQUIREMENTS FOR FABRICATORS OF DESIGNATED PARTS	
30	DCMP 164	A	CONTROL OF SERIALIZED PARTS & ASSEMBLIES	

Messier-Dowty Specification List

ITEM	NO.	REVLTR	TITLE	NOTE
31	DCMP 169	A	PRESERVATION AND PACKAGING	
32	DCMP 171	B	LOW EMBRITTLEMENT CADMIUM PLATING	
33	DCMP 172	E	CADMIUM PLATING (ELECTRODEPOSITED)	
34	DCMP 173			X 8933
35	DCNO 187	D	PREPARATION OF ZINC LOADED MASTINOX D40	
36	DCMP 189	B	ELECTRICAL BONDING	
37	DCMP 192	NC	VISUAL INSPECTION STANDARD GENERAL REQUIREMENTS FOR VISUAL INSPECTION	
38	DCMP 194	NC	SUPPLIER APPROVAL REQUIREMENTS FOR HEAT TREATMENT	
39	DCMP 199	B	SEALANT MATERIAL FOR CORROSION PROTECTION OF LANDING GEAR ASSEMBLIES	
40	DCMP 202	B	LUBRICATING GREASES SELECTION GUIDELINE	
41	DCMP 208	C	VACUUM GAS QUENCHING	
42	DCMP 209	B	ACCEPTANCE CRITERIA FOR RAW MATERIAL AND PARTS INSPECTED BY FLUORESCENT PENETRANT INSPECTION IN ACCORDANCE ASTM E1417	
43	DCMP 219	NC	COMPATIBILITY OF SKYDROL LD-4 AND 500B WITH ORHER MATERIALS	
44	DCMP 220	A	RESIN IMPREGNATION OF CHROMIUM PLATED SURFACES	
45	DCMP 2759/3			X

QUALITY CONTROL PROCEDURE LIST

ITEM	NO.	REVLTR	TITLE	NOTE
1	MIL-A-0625 type2class1			X
2	MIL-A-200/11			X
3	MIL-A-225/9			X
4	MIL-A-8243	D	ANTI-ICING ANDBEICING-DEFROSTING FLUIDS	
5	MIL-A-8625 ; MIL-A-8625 type2 class1	F	ANODIC COATINGS FOR ALUMINUM AND ALUMINUM ALLOYS	
6	MIL-B-81820	F	BEARINGS, PLAIN, SELF-ALIGNING, SELF-LUBRICATING, LOW SPEED OSCILLATION, GENERAL SPECIFICATION FOR(PEFER TO SAE AS 81820	
7	MIL-C-11796 class3	C	CORROSION PREVENTIVE COMPOUND PETROLATUM HOT APPLICATION	
8	MIL-C-15074	E	CORROSION PREVENTIVE, FINGERPRINT REMOVER	
9	MIL-C-16173 GR1	D	CORROSION REVENTIVE COMPOUND, SOLVENT CUTBACIS COLD-APPLICA TION	
10	MIL-C-5541 class1	E	CHEMICAL CONVERSION COATINGS ON ALLUMINUM AND ALUMINUM ALLOY	
11	MIL-C-83488 class3 type2			X
12	MIL-C-8837 class2 type2	B	GOATING, CADMIUM(VACUUM DEPOSITED) (PEFER TO SAE AMS C8837)	
13	MIL-G-23827			X
14	MIL-H-5606	G	HYDRAULIC FLUID, PETROLEUM BASE; AIRCRAFT; MISSILE AND ORDNANCE	
15	MIL-H-6875	H	HEAT TREATMENT OF STEEL RAW MATERIALS (PETER TO SAE AMS-H-6875)	
16	MIL-I-6866 MIL-I-6866 type1; MIL-I-6866 type1 method B; MIL-I-6866 type2 class	B	INSPECTION, LIQUID PENETRANT (SUPERSEDED BY MIL-STD-6868)	X
17	MIL-I-8950	B	INSPECTION, ULTRASONIC, WROUGHT METALS, PROCESS FOR(SUPERSEDED BY MIL-STD-2154)	X
18	MIL-L-8243			X
19	MIL-L-8625 type2 class1			X
20	MIL-P-416 class2 ; MIL-P-416 TYPE CLASS 2			X
21	MIL-S-13165	C	SHOT PEENING OF METAL PARTS (USE SAE AMS-S13165)	
22	MIL-S-5000	E	STEEL, CHROMSE-NICKEL-MOLYBDENUM (4340)BARS, AND FORGING STOCK (REFER TOSAE AMS-S-5000)	
23	MIL-S-5059	D	STEEL.CORROSION RESISTANT(18-8)PLATE. SHEET AND STRIP (USE AMS 5901. AMS 5517. AMS 5518. AMS 5902. AMS 5919. AMS 5516. AMS 5903. MAS 5904. AMS 5905. AMS 5906. AMS 5513. AMS 5910.AMS 5511, AMS 5912, AMS 5913, AMS 5524, AMS 5907)	
24	MIL-S-766			X
25	MIL-S-8844 class1	D	STEEL BAR. PERFORGING STOCK. AND MECHANICAL TUBING. LOW ALLOY. PREMIUM QUALITY (SUPERSEDED BY AMS 6414, AMS 6257)	
26	MIL-STD-1500 class2 type2	B	CADMIUM-TITANIUM PLATING, LOW EMBRITTLEMENT, ELECTRODEPOSITION	

QUALITY CONTROL PROCEDURE LIST

ITEM	NO.	REVLTR	TITLE	NOTE
27	MIL-STD-1907		INSPECTIN, LIQUID PENETRANT AND MAGNETIC PARTICLE, SOUNDNESS REQUIREMENTS FOR MATERIALS, PARTS AND WELDMENTS	
28	MIL-STD-1949	A	MAGNETIC PARTICLE INSPECTION(USE ASTM E1444)	
29	MIL-STD-271	F	REQUIREMENTS FOR NONDESTRUCTIVE TESTING METHODS (REFER TO NAVSEA TECHNICAL PUBLICATION T9074-AS-GIB-010/271)	
30	MIL-STD-6866		INSPECTION, LIQUID PENETRANT (USE ASTM E1417)	
31	MIL-STD-865	C	SELECTIVE (BRUSH PLTING), ELECTRODEPOSITION	
32	MIL-STD 870	B	CADMIUM PLATING, LOW EMBRITTLEMENT, ELECTROD EPOSITION	
33	MIL-STD-871	A	ELECTRO-CHEMICAL STRIPPING OF INORGANIC FINISHES	
34	QQ-A-200/11	E	ALUMINUM ALLOY 7075. BAT. ROD. SHAPES. TUBE AND WIRE, EXTRUDED(USE SAE AMS-QQ-A200/11, ASTM B221, ASTM B3080)	
35	QQ-A225/9	E	ALUMINUM ALLOY 7075 BAR, ROD, WIRE AND SPECIAL SHAPES; ROLLED, DRAWN OR COLD FINISED (PEFER TO SAE AMS-QQ-A225, ASTM B221)	
36	QQ-C-320 class2 type2	B	CHROMIUM PLATING (ELECTRODEPOSITED) (REFER TO SAE AMS-QQ-C320)	
37	QQ-C-390 ; QQ-C-390 #955 ; QQ-C-390 #955 type1; QQ-C-390 #955 type2; QQ-C-390 alloy#325 type 1 or 2 ; QQ-C-390 alloy#325 type 1 or 3 ;	B	COPPER ALLOY CASTINGS (INCLUDING CAST BAR) (PEFER TO ASTM B22, ASTM B30, ASTM B61, ASTM B62, ASTM B67, ASTM B505, ASTM B584, ASTM B763, ASTM B770, ASTM B806, AMS 4842, AMS 4845, AMS 4855, AMS 4860, AM	
38	QQ-C-530 ; QQ-C-530 alloy # 172;	C	COPPER-BERYLLIUM ALLOY BAR, ROD,ANDWIRE (COPPER ALLOY	
39	QQ-C-630			X
40	QQ-P-415 type2 class3			X
41	QQ-P-416 ; QQ-P-416 class 2 type 2; QQ-P-416 class 2 type 3; QQ-P-416 class 3type 2; QQ-P-416 class 3 type 1;	F	PLATING, CADMIUM (ELECTRODEPOSITED)	
42	QQ-S-766	D	STEEL, STAINLESS AND HEAT RESISTING, ALLOYS, PLATE, SHEET AND STRIP (REFER TO ASTM A240, ASTM A666, ASTM A693)	
43	AN 814-5DL		PLUG AND BLEEDER – SCREW THREAD (REFER TO SAE AS5169)	
44	AN 996-1; AN 996-16 ; AN 996-20 AN 996-22 ; AN 996-28		RING –LOCK	
45	FED STD 595 ; FED STANDARD 595		COLORS USED IN GOVERNMENT PROCUREMENT	
46	SSS-700			X
47	SSS-701			X
48	ATP 8243			X
49	ATP 8425			X
50	ATP 8333			X
51	ATP 8334			X
52	ATP 10533			X

QUALITY CONTROL PROCEDURE LIST

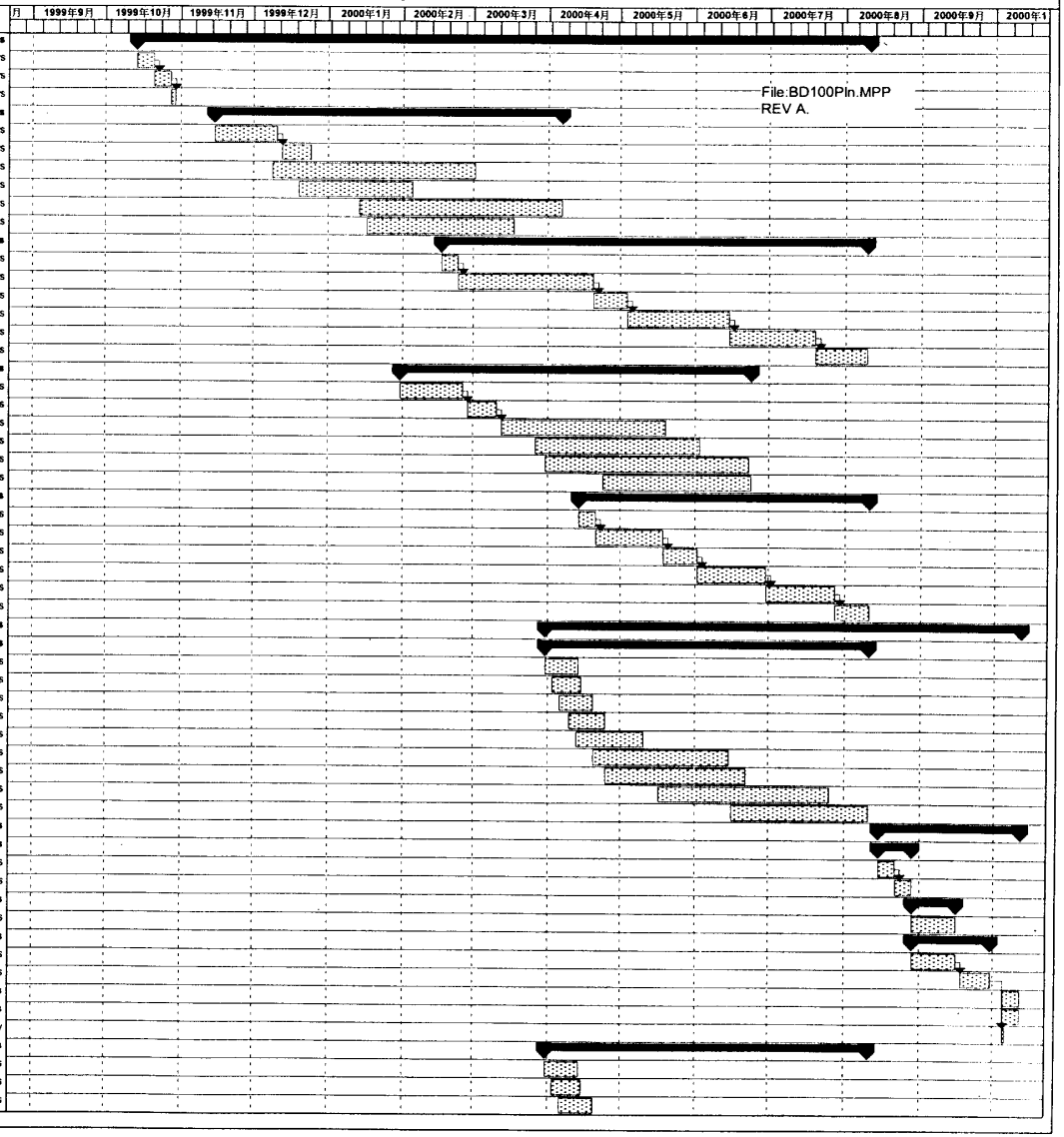
ITEM	NO.	REVLTR	TITLE	NOTE
53	ATP 10535			X
54	AS 1241	C	® FIRE RESISTANT PHOSPHATE ESTER HYDRAULIC FLUID FOR AIRCRAFT	
55	AS 5272 type2			X
56	AMS 2430	L	SHOT PEENING	
57	AMS 2431		PEENING MEDIA GENERAL REQUIREMENTS	
58	AMS 2431/1		PEENING MEDIA CAST STEEL SHOT, REGULAR (45-52HRC)	
59	AMS 2431/2		PEENING MEDIA CAST STEEL SHOT, HARD (55-62 HRC)	
60	AMS 2438		CHROMIUM COATING THIN, HARD, DENSE DEPOSIT	
61	AMS-4109			X
62	SAE AMS-4149	C	ALUMINUM ALLOY, DIE AND HAND FORGINGS 5.6Zn-2.5Mg-1.6Cu-0.23Cr (7175-T74)SOLUTION AND PRECIPITATION HEAT TREATED UNS A97175	
63	SAE AMS-4625	G	PHOSPHOR BRONZE BARS, RODS, AND TUBING 95Cu-5Sn HARD TEMPER UNS C51000	
64	SAE AMS-4640	F	ALUMINUM BRONZE, BARS, RODS, SHAPES, TUBES,AND FORGINGS 81.5 Cu-10.0Al-4.8Ni-3.0Fe DRAWN AND STRESS RELIEVED (HR50) OR TEMPER ANNEALED (TQ50) (UNS C63000)	
65	SAE AMS-5630	G	STEEL, CORROSION RESISTANT, BARS,WIRE, AND FORGINGS 17Cr-0.52Mo (0.95-1.20C) (SAE 51440C) (UNS S44004)	
66	SAE AMS-5643	P	STEEL, CORROSION RRESISTANT, BARS, WIRE, FORGINGS, TUBING, AND RINGS 16Cr-4.0Ni-0.30(Cb+Ta)-4.0Cu SOLUTION HEAT TREATED, PRECIPITATION HARDENABLE UNS S17400	
67	SAE AMS-5659	K	STEEL, CORROSION RESISTANT, BARS, WIRE, FORGINGS, RINGS, AND EXTRUSIONS 15Cr-4.5Ni-0.30Cb-3.5Cu CONSUMABLE ELECTRODE MELTED SOLUTION HEAT TREATED, PRECIPITATION HARDENABLE UNS S15500	
68	ASTM E-1417			X
69	AMS-2442		MAGNETIC PARTICLE ACCIPTANCE CHITERICA FOR PARTS	
70	AMS-2759/3			X
71	ASTM E-1444		STANDARD PRACTICE FOR MAGNETIC PARTICLE EXAMINATION	
72	O-A-548	D	ANTIFREEZE/COOLANT, ENGINE : ETHYLENE GLYCOL, INHIBITED, CONCENTRATED (USE A-A-870)	
73	VV-L-800	C	LUBRICATING OIL, GENERAL PURPOSE, PRESERVATIVE (WATER-DISPLACING, LOW TEMPERATURE) (SUPERSEDED BY MIL-PRF-32033)	

附件四

致動器製程流程資料

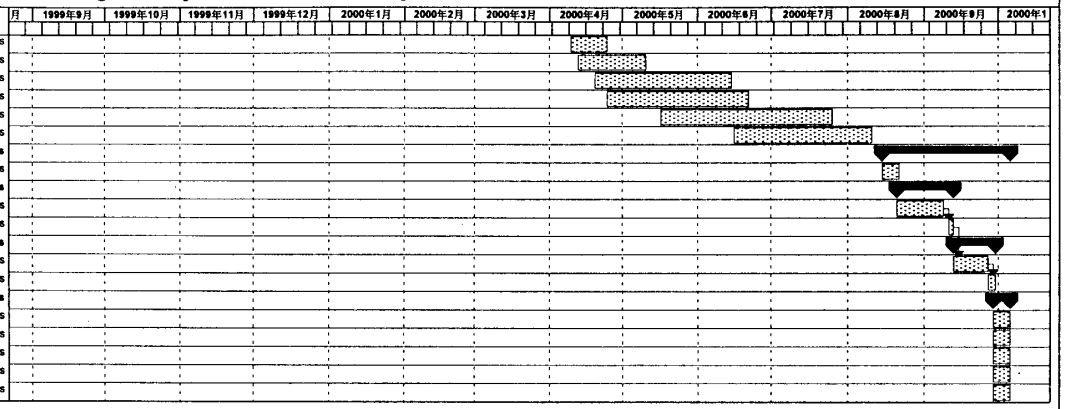
Manufacture Schedule - BD100
Landing Gear System - Messier-Dowty Toronto

識別番	Task Name	工期
1	**Inhouse Component Manufacturing**	**216 days**
2	Make/Buy Analysis	5 days
3	Machine Shop Capacity Analysis	5 days
4	Finalise Make/Buy	2 days
5	**Long Lead Piece Parts**	**104 days**
6	Methods Planning	20 days
7	Define Tooling Requirements	10 days
8	Design Long Lead Tooling	60 days
9	Order Long Lead	35 days
10	Recieve Long Lead Tooling	60 days
11	Inspect Tooling	45 days
12	**Begin Manufacture Long Lead Parts**	**125 days**
13	Raw Material	5 days
14	Rough Machining	40 days
15	Heat Treat	10 days
16	Finish Machining	30 days
17	Processing	25 days
18	First Artical Inspection	15 days
19	**Short Lead Piece Parts**	**105 days**
20	Methods Planning	20 days
21	Define Tooling Requirements	10 days
22	Design Short Lead Tooling	50 days
23	Order Short Lead Tooling	50 days
24	Recieve Short Lead Tooling	60 days
25	Inspect Tooling	45 days
26	**Begin Manufacture Short Lead Parts**	**85 days**
27	Raw Material	5 days
28	Rough Machining	20 days
29	Heat Treat	10 days
30	Finish Machining	20 days
31	Processing	20 days
32	First Artical Inspection	10 days
33	**Final Assembly**	**139 days**
34	**Nose Landing Gear Assembly Preparation**	**95 days**
35	Define Top Level Assemblies	10 days
36	Define Sub Assemblies	10 days
37	Define Assy and Sub Assy Tooling Requirements	10 days
38	Define Pre Delivery Test Proceedures	11 days
39	Define Test Equipment	20 days
40	Design Assy and Test Equipment	40 days
41	Order Assy and Test Equpment	42 days
42	Recieve Assy and Test Equipment	50 days
43	Inspect Assy and Test Equipment	40 days
44	**Nose Gear Assembly**	**42 days**
45	**Shock Strut Sub Assembly**	**10 days**
46	Shock,Piston&Axle,Torque Links, Int.Hware,Hard Piping	5 days
47	Shock Strut Assebmly Test	5 days
48	**Drag Brace Sub Assembly**	**14 days**
49	Upper Drag, Lower Drag, Hware Package	14 days
50	**Shock Strut Assembly Dressed**	**24 days**
51	Retract Act., Lights, Wheels and Tires	14 days
52	Functional Tests, Steer, Electics, Switch Calibration	10 days
53	**System Assy - Uplock**	**5 days**
54	**System Assy - Forward Door Mechanism**	**5 days**
55	**Crate And Ship To Canadair**	1 day
56	**Main Landing Gear Assembly Preparation**	**95 days**
57	Define Top Level Assemblies	10 days
58	Define Sub Assemblies	10 days
59	Define Assy and Sub Assy Tooling Requirements	10 days

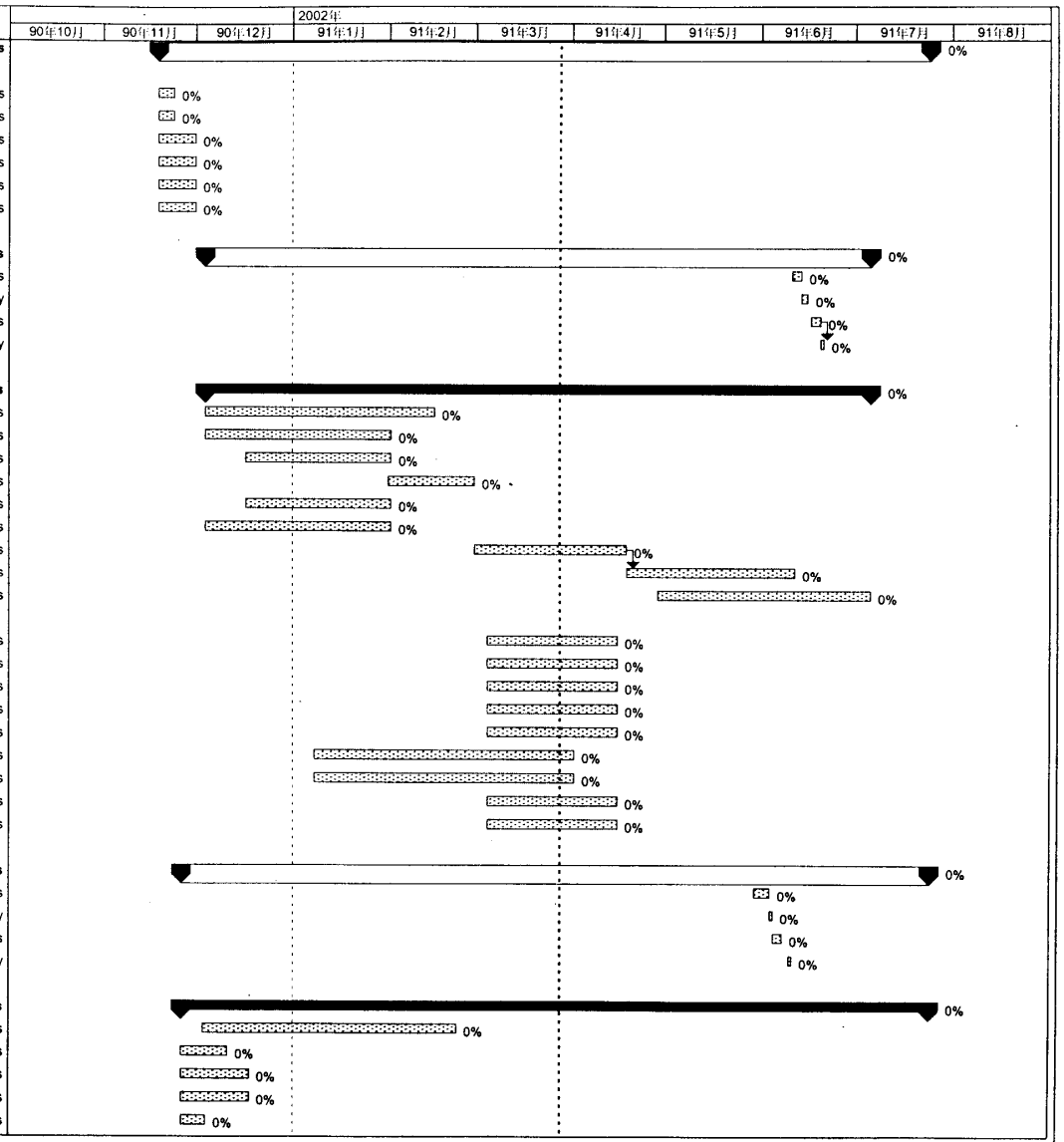


Manufacture Schedule - BD100
Landing Gear System - Messier-Dowty Toronto

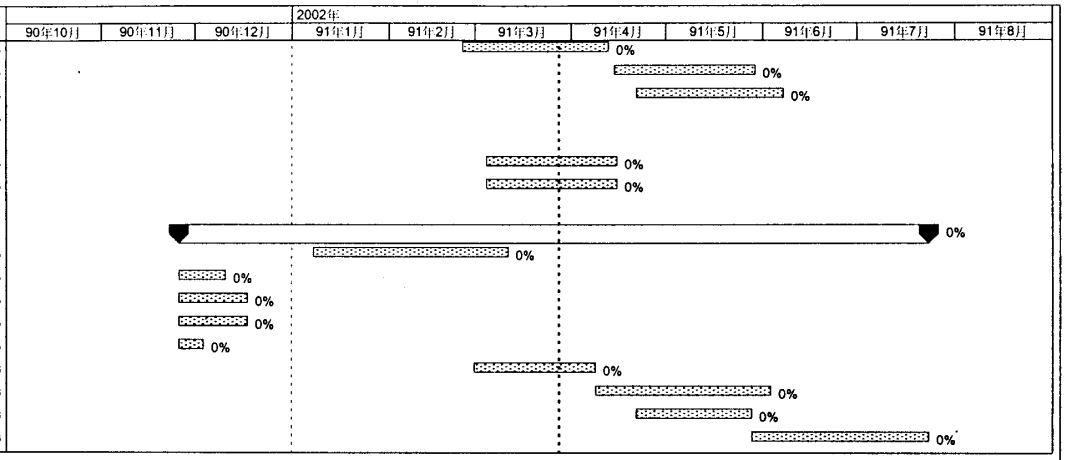
識別碼	Task Name	工期
60	Define Pre Delivery Test Proceedures	11 days
61	Define Test Equipment	20 days
62	Design Assy and Test Equipment	40 days
63	Order Assy and Test Equipment	42 days
64	Recieve Assy and Test Equipment	50 days
65	Inspect Assy and Test Equipment	40 days
66	**Main Landing Gear Assembly**	**38 days**
67	Main Landing Gear Sub-Ass'y Rec.	5 days
68	**Main Landing Gear Assembly**	**17 days**
69	Electreical Harness, Hydraulic Pipes, Hardware Package	15 days
70	Test Electrics and Hydraulics	2 days
71	**Main Landing Gear Fully Dressed**	**13 days**
72	Brakes, Wheels, Tires	10 days
73	Test Wheels and Brakes	3 days
74	**Aux. Systems**	**5 days**
75	**Side Brace Actuator Ass'y**	5 days
76	**Uplock Ass'y**	5 days
77	**Aux. Extad Actuator Ass'y**	5 days
78	**Pin Hardware for Side Brace**	5 days
79	**Package/Crate - Ship to Wichita**	5 days



識別碼	Items	Task Name	工期
1	**1.0.0**	**CL604 Components in Suzhou**	**178 days**
2			
3	1.1.0	Confirmation of forgings from MDT	5 days
4	1.1.1	Confirmation of Engrg Support from MDT	5 days
5	1.1.2	Acquire drawings from MDT	10 days
6	1.1.3	Acquire samples from MDT	10 days
7	1.1.4	Acquire FAI reports from MDT	10 days
8	1.1.5	Acquire historical record from MDT	10 days
9			
10	**2.0.0**	**20090-101 Main Fitting,S/A**	**154 days**
11	2.0.1	Bushing and Sub Assembly Machining	3 days
12	2.0.2	Sealing	1 day
13	2.0.3	Painting	3 days
14	2.0.4	Marking & FQA	1 day
15			
16	**2.1.1**	**20091-1 Main Fitting,Machining**	**154 days**
17	2.1.2	200811500 Main Fitting,Forging	54 days
18	2.1.3	Conversion of MDT Process	44 days
19	2.1.4	Transfer of fixture from MDT to China	35 days
20	2.1.42	Modification of MDT Fixtures for Table Slo	20 days
21	2.1.5	Transfer of toolings from MDT to China	35 days
22	2.1.6	Conversion of NC Program (MDT)	44 days
23	2.1.7	Testcut in Suzhou	35 days
24	2.1.72	Special Processing in Singapore	38 days
25	2.1.8	Production in Suzhou	50 days
26			
27	2.2.0	**200811621 Sleeve**	30 days
28	2.2.1	**200811669 Spacer**	30 days
29	2.2.2	**200811676 Bush**	30 days
30	2.2.3	**200811719 Bush**	30 days
31	2.2.4	**200811720 Dowel**	30 days
32	2.2.5	**857004028 Laminated Shim**	60 days
33	2.2.6	**857004031 Laminated Shim**	60 days
34	2.2.7	**858004081 Bush**	30 days
35	2.2.8	**858004087 Bush**	30 days
36			
37	**3.0.0**	**200811218 Axle,S/A**	**173 days**
38	3.0.1	Bushing	3 days
39	3.0.2	Sealing	1 day
40	3.0.3	Painting	3 days
41	3.0.4	Marking & FQA	1 day
42			
43	**3.1.0**	**200811308 Axle,Machining**	**173 days**
44	3.1.1	200811501 Axle,Forging	60 days
45	3.1.2	Manufacturing Process	11 days
46	3.1.3	Fabricate fixture in China	16 days
47	3.1.4	Acquire toolings from MDT	16 days
48	3.1.5	Preparation of NC Program	6 days



識別番	Items	Task Name	工期
49	3.1.6	Testcut in Suzhou	35 days
50	3.1.62	Special Process in Singapore	33 days
51	3.1.7	Production in Suzhou	35 days
52	3.1.72	Special Process in Singapore	33 days
53			
54	3.2.0	**857004029 Laminated Shim**	30 days
55	3.2.1	**858003016 Bush**	30 days
56			
57	**4.0.0**	**200811707 Sliding Tube**	**172 days**
58	4.0.1	Raw Material	45 days
59	4.0.2	Manufacturing Process	11 days
60	4.0.3	Acquire fixture from MDT	16 days
61	4.0.4	Acquire toolings from MDT	16 days
62	4.0.5	Preparation of NC Program	6 days
63	4.0.6	Testcut in Suzhou	27 days
64	4.0.62	Special Process in Singapore	40 days
65	4.0.7	Production in Suzhou	27 days
66	4.0.72	Special Process in Singapore	40 days



BD100 NLG CYLINDER - MESSIER-DOWTY M/SHOP

識別碼	Task Name	% Complt	工期	開始時間	完成時間	資源名稱
1	**20091-1 Cylinder, CL604 NLG - Machining**	**0%**	**170.5 days**	**90/11/22**	**91/7/18**	**M/Shop**
2	Rough Machining	0%	0 days	91/3/12	91/3/12	M/Shop
3	**Op#10 Raw Material Stores**	0%	1 day	91/3/13	91/3/13	M/Shop
4	**Op#20 Horz. Mill - Datum**	0%	3 days	91/3/14	91/3/18	M/Shop
5	**Op# 20 CNC Programming**	**0%**	**15 days**	**91/2/28**	**91/3/20**	
6	Program Creation Prog. No.	0%	5 days	91/2/28	91/3/6	CNC Prgr
7	Program Proveout Prog. No.	0%	5 days	91/3/14	91/3/20	CNC Prgr
8	**Op# 20 CMM Programming**	**0%**	**12 days**	**91/2/26**	**91/3/13**	
9	Program Creation Prog. No.	0%	5 days	91/2/26	91/3/4	CMM Prgr
10	Program Proveout Prog. No.	0%	2 days	91/3/12	91/3/13	CMM Prgr
11	**Op#20 Fixture ??????**	**0%**	**74.5 days**	**90/11/22**	**91/3/6**	
12	Fixture Design and Specification	0%	4 days	90/11/22	90/11/28	Tool Dsg
13	Fixture Quotation	0%	10 days	90/11/28	90/12/12	Logistics
14	Fixture Order	0%	0.5 days	90/12/12	90/12/12	Tool Dsg
15	Fixture Delivery	0%	30 days	90/12/13	91/1/23	Logistics
16	Fixture Inspection and Catalogue	0%	5 days	91/1/24	91/1/30	Inspect
17	Fixture Delivery to Machine	0%	25 days	91/1/31	91/3/6	Logistics
18	**Op# 20 Cutting Tools, Bungs, Jaws, Mandrels, Centers**	**0%**	**72.5 days**	**90/11/26**	**91/3/6**	
19	Create Cutting Tool Listing	0%	2 days	90/11/26	90/11/28	Tool Dsg
20	Cutting Tools Quotation	0%	10 days	90/11/28	90/12/12	Logistics
21	Cutting Tools Order	0%	0.5 days	90/12/12	90/12/12	Tool Dsg
22	Cutting Tools Delivery	0%	30 days	90/12/13	91/1/23	Logistics
23	Cutting Tools Inspection and Catalogue	0%	5 days	91/1/24	91/1/30	Inspect
24	Cutting Tool Delivery to Machine and Setup	0%	25 days	91/1/31	91/3/6	Logistics
25	**Op# 20 Measuring Guages, Plugs, Fixtures**	**0%**	**72.5 days**	**90/11/26**	**91/3/6**	
26	Create Measuring Tool Listing	0%	2 days	90/11/26	90/11/28	Tool Dsg
27	Measuring Tools Quotation	0%	10 days	90/11/28	90/12/12	Logistics
28	Measuring Tools Order	0%	0.5 days	90/12/12	90/12/12	Tool Dsg
29	Measuring Tools Delivery	0%	30 days	90/12/13	91/1/23	Logistics
30	Measuring Tools Inspection and Catalogue	0%	5 days	91/1/24	91/1/30	Inspect
31	Measuring Tools Delivery to Machine and Setup	0%	25 days	91/1/31	91/3/6	Logistics
32	**Op#30 Slant Lathe - Turn O/D and Bore**	0%	2 days	91/3/19	91/3/20	M/Shop
33	**Op# 30 CNC Programming**	**0%**	**12 days**	**91/3/5**	**91/3/20**	
34	Program Creation Prog. No.	0%	5 days	91/3/5	91/3/11	CNC Prgr
35	Program Proveout Prog. No.	0%	2 days	91/3/19	91/3/20	CNC Prgr
36	**Op#30 CMM Programming**	**0%**	**12 days**	**91/3/1**	**91/3/18**	
37	Program Creation Prog. No.	0%	5 days	91/3/1	91/3/7	CMM Prgr
38	Program Proveout Prog. No.	0%	2 days	91/3/15	91/3/18	CMM Prgr
39	**Op#30 Fixture ??????**	**0%**	**74.5 days**	**90/11/27**	**91/3/11**	
40	Fixture Design and Specification	0%	4 days	90/11/27	90/12/3	Tool Dsg
41	Fixture Quotation	0%	10 days	90/12/3	90/12/17	Logistics
42	Fixture Order	0%	0.5 days	90/12/17	90/12/17	Tool Dsg
43	Fixture Delivery	0%	30 days	90/12/18	91/1/28	Logistics
44	Fixture Inspection and Catalogue	0%	5 days	91/1/29	91/2/4	Inspect
45	Fixture Delivery to Machine	0%	25 days	91/2/5	91/3/11	Logistics
46	**Op# 30 Cutting Tools, Bungs, Jaws, Mandrels, Centers**	**0%**	**72.5 days**	**90/11/29**	**91/3/11**	
47	Create Cutting Tool Listing	0%	2 days	90/11/29	90/12/3	Tool Dsg
48	Cutting Tools Quotation	0%	10 days	90/12/3	90/12/17	Logistics
49	Cutting Tools Order	0%	0.5 days	90/12/17	90/12/17	Tool Dsg
50	Cutting Tools Delivery	0%	30 days	90/12/18	91/1/28	Logistics
51	Cutting Tools Inspection and Catalogue	0%	5 days	91/1/29	91/2/4	Inspect
52	Cutting Tool Delivery to Machine and Setup	0%	25 days	91/2/5	91/3/11	Logistics
53	**Op# 30 Measuring Guages, Plugs, Fixtures**	**0%**	**72.5 days**	**90/11/29**	**91/3/11**	
54	Create Measuring Tool Listing	0%	2 days	90/11/29	90/12/3	Tool Dsg
55	Measuring Tools Quotation	0%	10 days	90/12/3	90/12/17	Logistics
56	Measuring Tools Order	0%	0.5 days	90/12/17	90/12/17	Tool Dsg
57	Measuring Tools Delivery	0%	30 days	90/12/18	91/1/28	Logistics
58	Measuring Tools Inspection and Catalogue	0%	5 days	91/1/29	91/2/4	Inspect
59	Measuring Tools Delivery to Machine and Setup	0%	25 days	91/2/5	91/3/11	Logistics
60	**Op#40 Deep Hole - Rough Bore**	0%	2 days	91/3/21	91/3/22	M/Shop

BD100 NLG CYLINDER - MESSIER-DOWTY M/SHOP

識別碼	Task Name	% Complt	工期	開始時間	完成時間	資源名稱
61	**Op# 40 CNC Programming**	0%	12 days	91/3/7	91/3/22	
62	Program Creation Prog. No.	0%	5 days	91/3/7	91/3/13	CNC Prgr
63	Program Proveout Prog. No.	0%	2 days	91/3/21	91/3/22	CNC Prgr
64	**Op# 40 CMM Programming**	0%	12 days	91/3/5	91/3/20	
65	Program Creation Prog. No.	0%	5 days	91/3/5	91/3/11	CMM Prgr
66	Program Proveout Prog. No.	0%	2 days	91/3/19	91/3/20	CMM Prgr
67	**Op# 40 Fixture ??????**	0%	74.5 days	90/11/29	91/3/13	
68	Fixture Design and Specification	0%	4 days	90/11/29	90/12/5	Tool Dsg
69	Fixture Quotation	0%	10 days	90/12/5	90/12/19	Logistics
70	Fixture Order	0%	0.5 days	90/12/19	90/12/19	Tool Dsg
71	Fixture Delivery	0%	30 days	90/12/20	91/1/30	Logistics
72	Fixture Inspection and Catalogue	0%	5 days	91/1/31	91/2/6	Inspect
73	Fixture Delivery to Machine	0%	25 days	91/2/7	91/3/13	Logistics
74	**Op# 40 Cutting Tools, Bungs, Jaws, Mandrels, Centers**	0%	72.5 days	90/12/3	91/3/13	
75	Create Cutting Tool Listing	0%	2 days	90/12/3	90/12/5	Tool Dsg
76	Cutting Tools Quotation	0%	10 days	90/12/5	90/12/19	Logistics
77	Cutting Tools Order	0%	0.5 days	90/12/19	90/12/19	Tool Dsg
78	Cutting Tools Delivery	0%	30 days	90/12/20	91/1/30	Logistics
79	Cutting Tools Inspection and Catalogue	0%	5 days	91/1/31	91/2/6	Inspect
80	Cutting Tool Delivery to Machine and Setup	0%	25 days	91/2/7	91/3/13	Logistics
81	**Op#40 Measuring Guages, Plugs, Fixtures**	0%	72.5 days	90/12/3	91/3/13	
82	Create Measuring Tool Listing	0%	2 days	90/12/3	90/12/5	Tool Dsg
83	Measuring Tools Quotation	0%	10 days	90/12/5	90/12/19	Logistics
84	Measuring Tools Order	0%	0.5 days	90/12/19	90/12/19	Tool Dsg
85	Measuring Tools Delivery	0%	30 days	90/12/20	91/1/30	Logistics
86	Measuring Tools Inspection and Catalogue	0%	5 days	91/1/31	91/2/6	Inspect
87	Measuring Tools Delivery to Machine and Setup	0%	25 days	91/2/7	91/3/13	Logistics
88	**Op#50 Flat Lathe - Finish Bottom of Bore**	0%	2 days	91/3/25	91/3/26	M/Shop
89	**Op#50 CNC Programming**	0%	12 days	91/3/11	91/3/26	
90	Program Creation Prog. No.	0%	5 days	91/3/11	91/3/15	CNC Prgr
91	Program Proveout Prog. No.	0%	2 days	91/3/25	91/3/26	CNC Prgr
92	**Op# 50 CMM Programming**	0%	12 days	91/3/7	91/3/22	
93	Program Creation Prog. No.	0%	5 days	91/3/7	91/3/13	CMM Prgr
94	Program Proveout Prog. No.	0%	2 days	91/3/21	91/3/22	CMM Prgr
95	**Op# 50 Fixture ??????**	0%	74.5 days	90/12/3	91/3/15	
96	Fixture Design and Specification	0%	4 days	90/12/3	90/12/7	Tool Dsg
97	Fixture Quotation	0%	10 days	90/12/7	90/12/21	
98	Fixture Order	0%	0.5 days	90/12/21	90/12/21	Tool Dsg
99	Fixture Delivery	0%	30 days	90/12/24	91/2/1	
100	Fixture Inspection and Catalogue	0%	5 days	91/2/4	91/2/8	Inspect
101	Fixture Delivery to Machine	0%	25 days	91/2/11	91/3/15	
102	**Op#50 Cutting Tools, Bungs, Jaws, Mandrels, Centers**	0%	72.5 days	90/12/5	91/3/15	
103	Create Cutting Tool Listing	0%	2 days	90/12/5	90/12/7	Tool Dsg
104	Cutting Tools Quotation	0%	10 days	90/12/7	90/12/21	
105	Cutting Tools Order	0%	0.5 days	90/12/21	90/12/21	Tool Dsg
106	Cutting Tools Delivery	0%	30 days	90/12/24	91/2/1	
107	Cutting Tools Inspection and Catalogue	0%	5 days	91/2/4	91/2/8	Inspect
108	Cutting Tool Delivery to Machine and Setup	0%	25 days	91/2/11	91/3/15	
109	**Op# 50 Measuring Guages, Plugs, Fixtures**	0%	72.5 days	90/12/5	91/3/15	
110	Create Measuring Tool Listing	0%	2 days	90/12/5	90/12/7	Tool Dsg
111	Measuring Tools Quotation	0%	10 days	90/12/7	90/12/21	
112	Measuring Tools Order	0%	0.5 days	90/12/21	90/12/21	Tool Dsg
113	Measuring Tools Delivery	0%	30 days	90/12/24	91/2/1	
114	Measuring Tools Inspection and Catalogue	0%	5 days	91/2/4	91/2/8	Inspect
115	Measuring Tools Delivery to Machine and Setup	0%	25 days	91/2/11	91/3/15	
116	**Op#60 Flat Lathe - Turn O/D**	0%	2 days	91/3/27	91/3/28	M/Shop
117	**Op#70 Vertical Mill 4-Axis - Mill, Drill, Ream**	0%	3 days	91/3/29	91/4/2	M/Shop
118	**Op#80 Horz. Mill - Profile and Slot Lug, Remove Spigot**	0%	2 days	91/4/3	91/4/4	M/Shop
119	**Op#90 Horz. Mill - Mill 40 Deg. Pocket / Profile Mdl. Lug**	0%	2 days	91/4/5	91/4/8	M/Shop
120	**Semi-Finish Machining**	0%	0 days	91/4/8	91/4/8	M/Shop

BD100 NLG CYLINDER - MESSIER-DOWTY M/SHOP

識別碼	Task Name	% Complt	工期	開始時間	完成時間	資源名稱
121	Op#100 Horz. Mill - Finish Bores and Faces	0%	3 days	91/4/9	91/4/11	M/Shop
122	Op#110 Flat Lathe - Turn Steady Diam.	0%	2 days	91/4/12	91/4/15	M/Shop
123	Op#120 Flat Late - Finish Front of Bore	0%	3 days	91/4/16	91/4/18	M/Shop
124	Op#130 Flat Lathe - Finish O/D Profile	0%	2 days	91/4/19	91/4/22	M/Shop
125	Op#140 MCH800 - Produce Trunion X-Holes	0%	3 days	91/4/23	91/4/25	M/Shop
126	Op#180 Bench - Deburr	0%	3 days	91/4/26	91/4/30	M/Shop
127	Op#185 NDT - Liquid Penetrant	0%	10 days	91/5/1	91/5/14	M/Shop
128	Op#190 Bench - Hone Bores	0%	2 days	91/5/15	91/5/16	M/Shop
129	Op#200 Ex-Cello - Hone Main Bore	0%	3 days	91/5/17	91/5/21	M/Shop
130	Op#210 View Room - Inspect 100% Manditory	0%	3 days	91/5/22	91/5/24	M/Shop
131	Processing	0%	0 days	91/5/24	91/5/24	M/Shop
132	Op#220 Sub Contact - Shot Peen	0%	10 days	91/5/27	91/6/7	M/Shop
133	Op#225 Manual Lathe - Polish Diams.	0%	2 days	91/6/10	91/6/11	M/Shop
134	Op#240 Horz. Mill - Drill and Bore 4 Holes	0%	3 days	91/6/12	91/6/14	M/Shop
135	Op#250 NDT - Liquid Penetrant	0%	5 days	91/6/17	91/6/21	M/Shop
136	Op#260 Bench - Deburr	0%	1 day	91/6/24	91/6/24	M/Shop
137	Op#270 View Room - Inspect 100% Manditory	0%	1 day	91/6/25	91/6/25	M/Shop
138	Op#275 Sub Contract - Chromic Anodize	0%	10 days	91/6/26	91/7/9	M/Shop
139	Final View - First Article	0%	7 days	91/7/10	91/7/18	M/Shop

附件五

Skydrol 500 液壓油資料

800 NORTH LINDBERGH BOULEVARD
ST LOUIS MISSOURI
U.S.A. 63166

Emergency Telephone: 314-694-4000 (CALL COLLECT)

Distributor: MONSANTO CANADA INC

2330 ARGENTIA ROAD
MISSISSAUGA ONTARIO
CANADA L5M 2B4
Telephone: 416-826-9222
Telex: 06219651

425 ST PATRICK STREET
LASALLE QUEBEC
CANADA H8N 2H3
Telephone: 514-368-4850

Emergency Telephone: 514-366-5588 (CALL COLLECT)
613-996-6666 (CANUTEC)

* * *

MONSANTO PRODUCT NAME	MONSANTO COMPANY 800 NORTH LINDBERGH BLVD. ST. LOUIS, MO 63167 EMERGENCY PHONE NO. (CALL COLLECT) (314) 694-1000
SKYDROL 500B-4 FIRE RESISTANT HYDRAULIC FLUID	

PRODUCT IDENTIFICATION

Skydrol 500B-4 fire resistant hydraulic fluid is a proprietary product. The formulation is a trade secret of Monsanto Company. All components of Skydrol 500B-4 hydraulic fluid appear on the Inventory of Chemical Substances published by the U.S. Environmental Protection Agency (EPA) under the authority of the Toxic Substance Control Act (TSCA).

Chemical Family: Phosphate Esters with performance additives.

DOT Hazard Class: This product is not classified as a hazardous material by the U.S. Department of Transportation

Label Requirement: Product Label

U.S. Surface Freight Classification: Hydraulic Systems Fluid, other than Petroleum.

Report Quantity (RQ) Under U.S. EPA CERCLA Regulations: Not Listed

Hazardous Chemical(s) Under OSHA Hazard

Communication Standard: This product contains, as components, the substances listed below which are identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200):

Tributyl Phosphate (CAS No. 126-73-8)
Dibutyl Phenyl Phosphate, (CAS No. 2528-36-1)

WARNING STATEMENTS

CAUTION!
MAY CAUSE IRRITATION TO EYES, SKIN, AND RESPIRATORY TRACT

PRECAUTIONARY MEASURES

Avoid contact with eyes, skin, and clothing
Avoid breathing vapor or mist.
Use with adequate ventilation.
Keep container closed.
Wash thoroughly after handling.

Emptied container retains vapor and product residue. Observe all labeled, safeguards until container is destroyed. DO NOT REUSE THIS CONTAINER.

EMERGENCY AND FIRST AID PROCEDURES

FIRST AID: IF IN EYES, immediately flush with plenty of water. Call a physician if irritation persists.

IF ON SKIN, immediately flush with plenty of water. Wash clothing before reuse.

IF INHALED, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.

Skin Protection: Wear appropriate protective gloves that provide a barrier and protective clothing to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear a face shield and an apron that provides a barrier when splashing is likely. Wash contaminated skin promptly. Launder contaminated clothing and clean protective equipment before reuse. Wash thoroughly after handling.

Respiratory Protection: Handling this product at room temperature should not present an inhalation hazard since the material has a low vapor pressure. If the material is heated and released or aerosolized in a mist form in excessive concentrations, use NIOSH/MSHA approved respiratory protective equipment. Consult respirator manufacturer to determine type equipment for given application. Respiratory protection programs must be in compliance with the OSHA Respiratory Protection Standard (29 CFR 1910.134).

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Ventilation: No special ventilation is required besides good room ventilation. If heated material is released or aerosolized, local mechanical exhaust ventilation should be used at the source of air contamination.

Airborne Exposure Limits:

Product: Dibutyl Phenyl Phosphate (CAS No. 2528-36-1)

OSHA PEL:	None Established
ACGIH TLV:	None Established

Product: Tributyl Phosphate (CAS No. 126-73-8)

OSHA PEL/TWA:	5 mg/m3 (0.4 ppm) time-weighted average
ACGIH TLV/TWA:	2.5 mg/m3 (0.2 ppm) time-weighted average
ACGIH TLV/STEL:	5 mg/m3 (0.4 ppm)

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FIRE PROTECTION INFORMATION

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Flash Point: 320f Method: Cleveland Open Cup

Fire Point: 350f Method: Cleveland Open Cup

Autoignition Temp.: 750f Method: ASTM D-2155

Extinguishing Media: Water spray, foam, dry chemical, carbon dioxide or any Class B extinguishing agent.

Special Fire Fighting Procedures: Fire fighters or others exposed to products of combustion should wear full protective clothing including self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

Unusual Fire and Explosion Hazards: Products of decomposition include hazardous carbon monoxide, carbon dioxide, and oxides of phosphorus.

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REACTIVITY DATA

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Stability: Product is stable under ordinary conditions of handling and storage and under continued use up to approximately 250-275f.

Materials to Avoid: Exposure to strong oxidizing agents may result in generation of heat and combustion products.

REACTIVITY DATA - CONTINUED

Hazardous Decomposition Products: Oxides of phosphorus may form. No other uniquely hazardous decomposition products are expected. If the product is burned, as with any organic material, carbon monoxide and soot can be produced.

Hazardous Polymerization: Does not occur.

HEALTH EFFECTS SUMMARY

The following information presents both human experience and the results of scientific experiments used by qualified experts to assess the effects of Skydrol 500B-4 fire resistant hydraulic fluid on the health of industrially exposed individuals and to support the Precautionary Statements and Occupational Control Procedures recommended in this document. To avoid misunderstanding, the data provided in this section should be interpreted by individuals trained in evaluation of this type of information.

Human Experience

Dermal contact and inhalation are expected to be the primary routes of occupational exposure to Skydrol 500B-4 fire resistant hydraulic fluid. Eye contact with this product has been reported to produce marked pain in the eyes but has not been reported to cause damage to the eyes. Irritation in the form of drying and cracking of exposed skin may be caused by repeated or prolonged skin contact with this material. Exposure to the aerosolized Skydrol 500B-4 fluid or vapors of Skydrol 500B-4 hydraulic fluid produced at high temperatures has been reported to produce nose and throat irritation accompanied by coughing and wheezing. Inhalation of Tributyl Phosphate, a component of Skydrol 500B-4, at concentrations above the recommended TLV may cause nausea and headache.

Toxicological Data

Data from Monsanto studies indicate the following:

Skydrol 500B-4 fire resistant hydraulic fluid

Oral LD50 (Rat):	2,200 mg/kg, Slightly Toxic
Dermal LD50 (Rabbit):	Greater than 7,940 mg/kg, Practically Nontoxic
Eye Irritation (Rabbit):	(FHSA) 2.4 on a scale of 110.0, Slightly Irritating
Skin Irritation (Rabbit):	(FHSA) 2.5 on a scale of 8.0, Slightly Irritating
Vapor Inhalation 4-hr LC50 (Rat):	Greater than 4.5 mg/l. No mortality was observed at 4.5 mg/l, the highest atmostpheric concentration achievable in this study.

HEALTH EFFECTS SUMMARY - CONTINUED

Patch testing of 53 human volunteers with Skydrol 500B-4 hydraulic fluid produced no positive reactions following initial application; 14 out of 53 subjects displayed reactions during subsequent induction exposes. No reaction

was observed on challenge. Skydrol 500B-4 fluid is not considered a primary irritant or a dermal sensitizing agent.

Components

Data from Monsanto studies and from the available literature on the components of Skydrol 500B-4 hydraulic fluid which have been identified under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200) are discussed below:

Dibutyl Phenyl Phosphate

Patch testing of 50 human volunteers with dibutyl phenyl phosphate produced positive reactions in 2 out of 50 subjects following the first two applications; no positive reactions were observed during subsequent repeated induction exposures. No reaction was observed on challenge. Dibutyl phenyl phosphate is not considered a primary irritant or a sensitizing agent.

A neurotoxicity study was conducted with dibutyl phenyl phosphate in adult hens. Adult hens were dosed orally with a single dose of 1.34 g/kg. This dose was repeated 21 days later. No gross signs of neurological effects and no microscopic evidence of demyelination in brain, spinal cord or sciatic nerve were observed.

Dibutyl phenyl phosphate was applied to the intact and abraded skin of rabbits at dosages of 10, 100, and 1000 mg/kg/day for 6 hours/day, 5 days/week for 3 weeks. Dermal irritation was observed at the site of application. Significant reductions of plasma cholinesterase activity were determined for high-dose males and females and for mid-dose males. Slight reductions in brain and erythrocyte cholinesterase activities were determined for high-dose males and females and for high-dose males, respectively. No other adverse biochemical, hematological or urinalysis effects were observed. The systemic no-effect level was considered to be 10 mg/kg/day.

Dibutyl phenyl phosphate was administered to rats at dietary concentrations evquivalent to 50, 150 or 500 mg/kg/day for 90 days. Decreased body weight gains and food consumption were observed at the high-dose exposure level. Increased liver weight/liver-to-body weight ratios and decreased lung weights were observed in the mid- and/or high-dose exposure groups. Hematologic parameter alterations were reported in all treatment groups; biochemical parameter alterations were reported in the high-dose group. Histopathologic lesions were noted in liver, kidneys, bladder, and ovaries of most treatment

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In a subsequent 90-day study, rats were administered dibutyl phenyl phosphate in the diet of a dosage of 5 mg/kg/day. No adverse hematological or histopathological effects and no changes in plasma or erythrocyte cholinesterase activity were observed.

No teratogenic or fetotoxic effects were observed in the offspring of rats administered dibutyl phenyl phosphate by gavage at a dosage of 3, 30 or 300 mg/kg/day on days 6 through 15 of gestation. No maternal toxic effects were observed at any treatment level.

Dibutyl phenyl phosphate was evaluated for mutagenic or genotoxic potential in the following systems: microbial assays with five Salmonella strains and one strain of Saccharomyces yeast; in vitro induction of L5178Y TK mouse lymphoma cell point mutations; and a hepatocyte primary culture/DNA repair assay. No mutagenic activity was observed in any of these assays.

Tributyl Phosphate

Single intraperitoneal injections of tributyl phosphate at dosages of 850 to 1,000 mg/kg were reported to cause paralysis in mice.

A neurotoxicity study was conducted with tributyl phosphate in adult hens. Adult hens were dosed orally with a single dose of 1.84 g/kg. This dose was repeated 21 days later. No gross signs of neurological effects and no microscopic evidence of demyelination in brain, spinal cord or sciatic nerve were observed.

Tributyl phosphate was administered to rats by gavage at doses of 0.28 and 0.42 ml/kg/day for 14 consecutive days. Decreased body weights were reported in all treatment groups at 7 days and in low-dose females at 14 days. Conduction velocity of the caudal nerve was reduced in high-dose males. Increases in refractory periods of caudal nerve were reported in high- and low-dose groups. Morphological alterations in unmyelinated fibers were reported in the high-dose groups. No axonal degeneration was observed.

Rats were administered tributyl phosphate by gavage at dosed of 0.14 to 0.42 ml/kg/day for 14 consecutive days. Alterations in organ weights and hematological and biochemical parameters were reported in low- and/or high-dose treatment groups. One of 4 male rats in the high-dose group examined for histopathological changes was reported to show degenerative changes in the seminiferous tubules. No other histopathological abnormalities were observed.

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Reduced body weights, reduced feed consumption and altered organ weights with decreased serum enzyme and glucose levels and increased cholesterol and/or urea nitrogen levels were reported in male rats fed dietary concentrations of 0.5% and 1.0% tributyl phosphate for 10 weeks. Blood coagulation times were also prolonged following this in vivo treatment with tributyl phosphate, brain cholinesterase activity was significantly elevated. Activities of serum and liver cholinesterase did not change. Following in vitro treatment of rat brain and liver homogenates and serum with tributyl phosphate, no change in cholinesterase activities were reported.

Rats were fed diets containing tributyl phosphate at levels of 8, 40, 200, 1000 or 5000 ppm for 90 days. Hematological, biochemical, and coagulation parameter changes and increased liver weights were reported in the high-dose animals. Urinary bladder hyperplasia was observed among male and female rats at 5000 ppm and among males given 1000 ppm. In a separate study, male and female rats given tributyl phosphate by gavage at levels of 0.20 and 0.30-0.35 ml/kg/day 5 days/week for 18 weeks were also reported to exhibit urinary bladder hyperplasia.

Another feeding study was conducted in rats with tributyl phosphate at

a dietary level of 0.5% for 9 weeks. Decreased body weights and altered organ weights with increased urea nitrogen levels were reported. No adverse effects on hematological parameters, blood coagulation time, or serum enzyme activities were reported.

Cholinesterase activities of human red cell hemolysate (substrate concentration 1x10-3 M acetylcholine) and human plasma (substrate concentration 1x10-2 M acetylcholine) were reported to be inhibited by tributyl phosphate in vitro.

Tributyl phosphate administered intraperitoneally to rats at dosages ranging from 16 to 226 mg/kg produced a dose-dependent increase in serum -glucuronidase activity. No effect on serum cholinesterase activity was reported at any dose level tested.

No mutagenic activity was reported in microbial assays using Salmonella and Escherichia organisms or in a sex-linked dominant lethal assay in Drosophila.

Following a single oral dose (14 mg/kg) of radiolabeled tributyl phosphate to male rats, 50%, 10% and 6% of the administered radiolabel was reported to be excreted in urine, exhaled air, and feces, respectively, within one day. Male rats given a single intraperitoneal dose (14 mg/kg) of radiolabeled tributyl phosphate were reported to excrete 70%, 7% and 4% of the administered radiolabel in urine, exhaled air, and feces, respectively, within one day.

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Additional Information

A Threshold Limit Value (TLV) has been established by the American Conference of Governmental Industrial Hygienists for tributyl phosphate. For further information on tributyl phosphate, please refer to the current edition of the Documentation of Threshold Limit Values.

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PHYSICAL DATA

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Appearance: Clear, purple, oily liquid

Boiling Point @ 267 mm Hg (Based on Vapor Pressure Data): Approximately 257f

Pour Point: Less than -80f (Maximum)

Specific Gravity (25/25c): 1.052-1.060

Viscosity @ 100f: 10.8-11.6 cs

Refractive Index, n 25/D: 1.466-1.474

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

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SPILL, LEAK AND DISPOSAL INFORMATION

Emergency Spill and Leak Information: Absorb spilled or leaked material on clay, sawdust, or other absorbent material and dispose of as recommended below.

Disposal Information: Waste should be incinerated or disposed of in a hazardous waste landfill. Either disposal route should be in accordance with all local, state or federal regulations. This material should be not be spilled, dumped, rinsed or washed into sewers or public waterways.

ADDITIONAL COMMENTS

Environmental Toxicity Information:

Skydrol 500B-4 fire resistant hydraulic fluid

48-hr EC50 Daphnia magna: 6.5 mg/l, Moderately Toxic
48-hr EC50 Algae (Chlorophyll): 7.1 mg/l, Moderately Toxic
96-hr EC50 Algae (Cell Count): 8.9 mg/l, Moderately Toxic
96-hr LC50 Fathead Minnow: 3.0 mg/l, Moderately Toxic
96-hr LC50 Rainbow Trout: 2.6 mg/l, Moderately Toxic

Dibutyl Phenyl Phosphate

96-hr TC50 Bluegill Sunfish: Estimated to be between 1 and 10 ppm, Moderately Toxic
14-Day LC50 Rainbow Trout: 2.4 mg/l

Daphnia magna were exposed to dibutyl phenyl phosphate concentrations of 0.014, 0.028, 0.055, 0.092 and 0.25 mg/l through one generation (21 days). Increased mortality, reductions in the total length of Daphnia at 7 days and reductions in the percent of gravid females were observed at 0.25 mg/l. The maximum acceptable toxicant concentration was greater than 0.092 mg/l and less than 0.25 mg/l.

Rainbow trout eggs were exposed to dibutyl phenyl phosphate concentrations ranging from 0.007 to 0.110 mg/l. No treatment-related effects were observed on hatchability of eggs or on growth and survival of the fry. The maximum acceptable toxicant concentration was greater than 0.110 mg/l.

Dibutyl phenyl phosphate had a primary degradation rate of greater than 95% in a semi-continuous activated sludge test; this material was classified as readily degraded. In a river die-away study, dibutyl phenyl phosphate was classified as being readily degraded.

Tributyl Phosphate

Tributyl phosphate was evaluated in a semi-continuous activated sludge test, the Thompson-Duthie-Sturm biodegradation assay and in a river die-away test. Based on results from these assays, tributyl phosphate was classed as readily degraded.

Product Qualifies under the following specifications:

BMS 3-11F, Type IV, Class 2, Grade A

附件六

Messier-Dowty 品保資料

Messier-Dowty
snecma group

Summary of PRIDE Requirements

The following Summary provides a highlight of some of the key requirements of the PRIDE Manual (Process Requirements In Developing Excellence). For details, please refer to the actual PRIDE Manual (available on-line at **www.messier-dowty.on.ca**; username: **supplier**; password: **sd99sugp**).

1) Process Approvals *(PRIDE Sections 4.9 & 5.2)*

Any drawing where **DCMP 163** is called out ("Control Requirements for Fabricators of Designated Parts") requires the Manufacturing Plan and Special Process Techniques to be approved by MDI (Messier-Dowty Inc.) **prior to the commencement of production.** (In order to meet delivery commitments, the Supplier is allowed perform rough machining operations, up to Heat Treat, prior to receipt of the MDI-approved Plan / Techniques). MDI's Quality Engineering Dept. reserves the right to request the Manufacturing Plan and Special Process Techniques for non-DCMP 163 parts, as well. Following MDI approval, the Manufacturing Plan and Special Process Techniques become "**FROZEN**".

Special Process Techniques must be submitted for the following processes: Heat Treatment, Shot Peening, NDT, Grinding and other **Part-Specific** processes. (Non-part-specific processes, such as Chrome per QQ-C-320, or Cadmium Plating per QQ-P-416, are exempt).

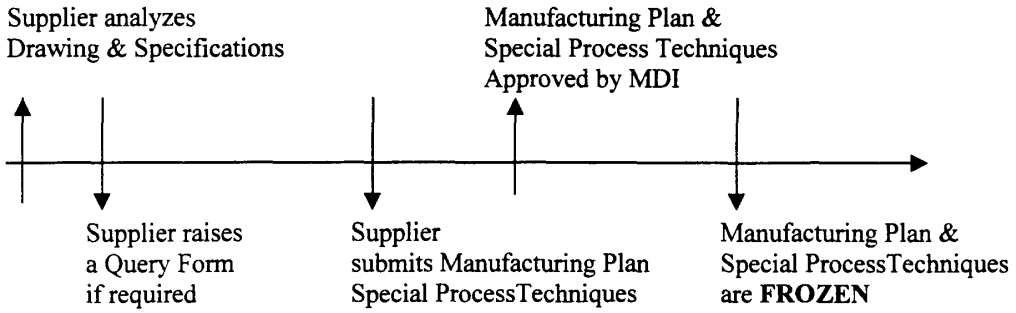
A Technique Sheet No. (TS No.) will be issued for each Manufacturing Plan and Special Process Technique upon approval by MDI. Any significant **changes** to the Manufacturing Plan or Special Process Techniques must only be implemented after re-submittal and approval by MDI.

To ensure that parts are processed in accordance with approved procedures, the TS No. for each Special Process Technique should be **incorporated** into the Supplier's Manufacturing Plan. Also, the TS No. must be specified on Purchase Orders issued from Suppliers to approved Process Sources.

For example, a typical Purchase Order should read:

Parts to be Heat Treated per AMS 2759B and TS002211 Rev. 1

Following is a simplified chart showing the developmental stages of the Manufacturing Plan and Special Process Techniques in the production of Critical Parts:



2) Serialization *(PRIDE Section 5.3)*

When the drawing (and MDI Purchase Order) calls out serialization for detail parts, sub-assemblies, assemblies, or LRU's (Line Replacement Units), the Supplier is required to submit a **Request for Serialization Form** to MDI (Att'n: Linda MacBurnie), at the onset of manufacture. Starting Serial Numbers are issued by MDI, and take the following form: **ABC-xxxx**

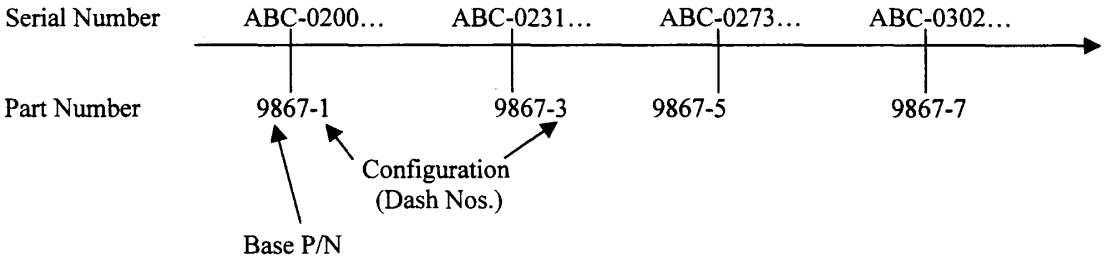
Supplier's own prefix (confirmed by MDI)

4-Digit Number assigned by MDI

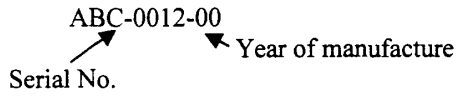
The Supplier must maintain a Log of Serial Numbers for each part Number, to ensure traceability. Serial Numbers must not be duplicated throughout the lifetime of the product!

Note: The Kit Serial Number (on the Kit Warrant Form and the Kit label) also has a sequential Serial Number: 1,2,3,4, etc. (based on quantity of deliveries).

The serial number of details and assemblies shall not change and restart from zero, when there is a configuration change. The serial number is controlled by the base part number.



For **LRU's,** the Serial Numbers are controlled as above, and the Year of Manufacture is added, as follows:

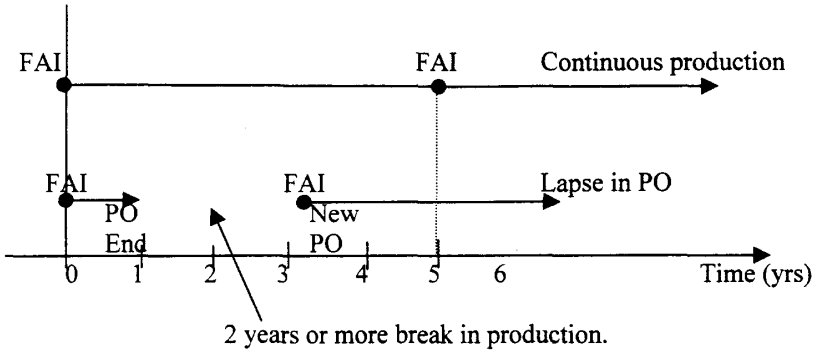


Following issuance of the starting Serial Number from MDI, Serialization Control is the responsibility of the Supplier. MDI will conduct audits of the Supplier's Serialization Controls on a periodic basis.

3) FAIR's - First Article Inspection Reports *(PRIDE Section 5.1)*

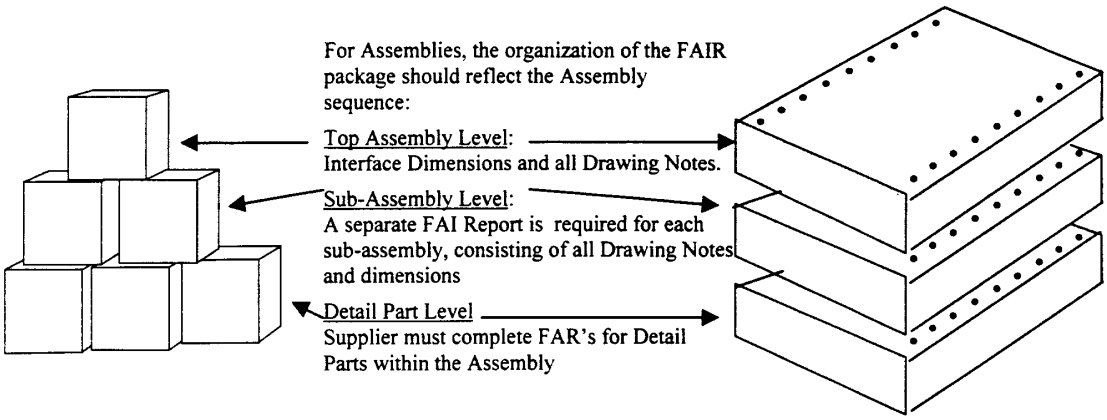
First Article Inspection of all detail components, sub-assemblies and top assembly must be performed on one piece part of the first manufacturing batch. The part is chosen and tagged by the Supplier.

For continuous production, FAIR's are to be performed once every 5 years. However, if there has been a break in production of two years or more, a new FAI must be performed again, when production of the same part resumes.



FAIR's (First Article Inspection Reports) are required for all Part Numbers, including details, sub-assemblies, assemblies, and LRU's. Here are the general rules that apply when completing FAIR's:

1. 100% of the drawing dimensions and drawing features / notes must be measured / recorded
2. the First Article Part must be labelled with a "Sample Parts" Tag
3. a marked-up print (with each dimension and drawing note clearly identified by a number, corresponding to the item on the FAIR) must accompany the First Article Paperwork
4. copies of all supporting documentation (Material Certs., Special Process C. of C.'s, Acceptance Test Procedures / Acceptance Test Reports (ATP's / ATR's), etc., must accompany the FAIR
5. the weight must be recorded for each detail component.



4) Concessions / NCR's - Non-Conformance Reports *(PRIDE Section 5.5)*

A Concession is a Non-Conformance Report, recorded by the Supplier, and submitted to MDI for disposition. The actual non-conforming parts must be held in quarantine at the Supplier's facilities, pending MDI disposition.

In order for MDI to respond with the correct disposition, the Supplier must provide a complete and clear description of the non-conforming condition. Provide photos or sketches if possible, to clarify the defect description. If the Supplier requires guidance as to what information should be provided on the Concession Form, they are advised to contact the applicable Quality Engineer. Complete instructions on how to properly fill out a Concession form are found in section 5.5 of the PRIDE Manual.

Where applicable, the Supplier may propose a desired disposition and rework / repair method which may be workable for them.

Each Concession should apply to one Supplier (Internal) Job Number only.

Multiple defects on the parts (within the same Job Number) can be listed under separate items on the Concession form.

Attachments to Concessions shall reference the Part Number and internal Job Number.

The Supplier must complete all 5 blocks of the "Corrective Action" Section of the Non-Conformance Record. Attach extra pages if additional space is required.

All Parts delivered to MDI which are on Concession must be accompanied by hard copies of the MDI-dispositioned Concessions. Also, the Concession Nos. must be recorded on the C. of C.'s.

For Kits, a hard copy of applicable "closed" (i.e.: MDI-dispositioned) Concessions are to be shipped together with the kit, attached to the Kit Warrant.

5) Delivery Documentation *(PRIDE Section 5.4)*

Details and Assemblies(no functional tests required)

For Detail Parts and Assemblies (which do not require ATP's / ATR's), the following documentation must be supplied with each shipment:

C. of C. (Certificate of Compliance), and Supplier Warrant of Material (or if the part is classified on the drawing as critical (DCMP 163).

LRU's (Line Replacement Units)

For LRU's (Line Replacement Units), the following documentation must be supplied with each shipment:

C of C, ATR (Acceptance Test Record), Build Record.

Kits

For Kits, the following documentation must be supplied with each shipment:

Kit Warrant (Form to be supplied by MDI) and Supplier Warrant of Material (for DCMP 163 parts only), ATR, Concessions (include hard copies).

Note: All related documents must be maintained at the Supplier's facilities, and made available to MDI for review at any time.

6) Forms *(PRIDE Section 5)*

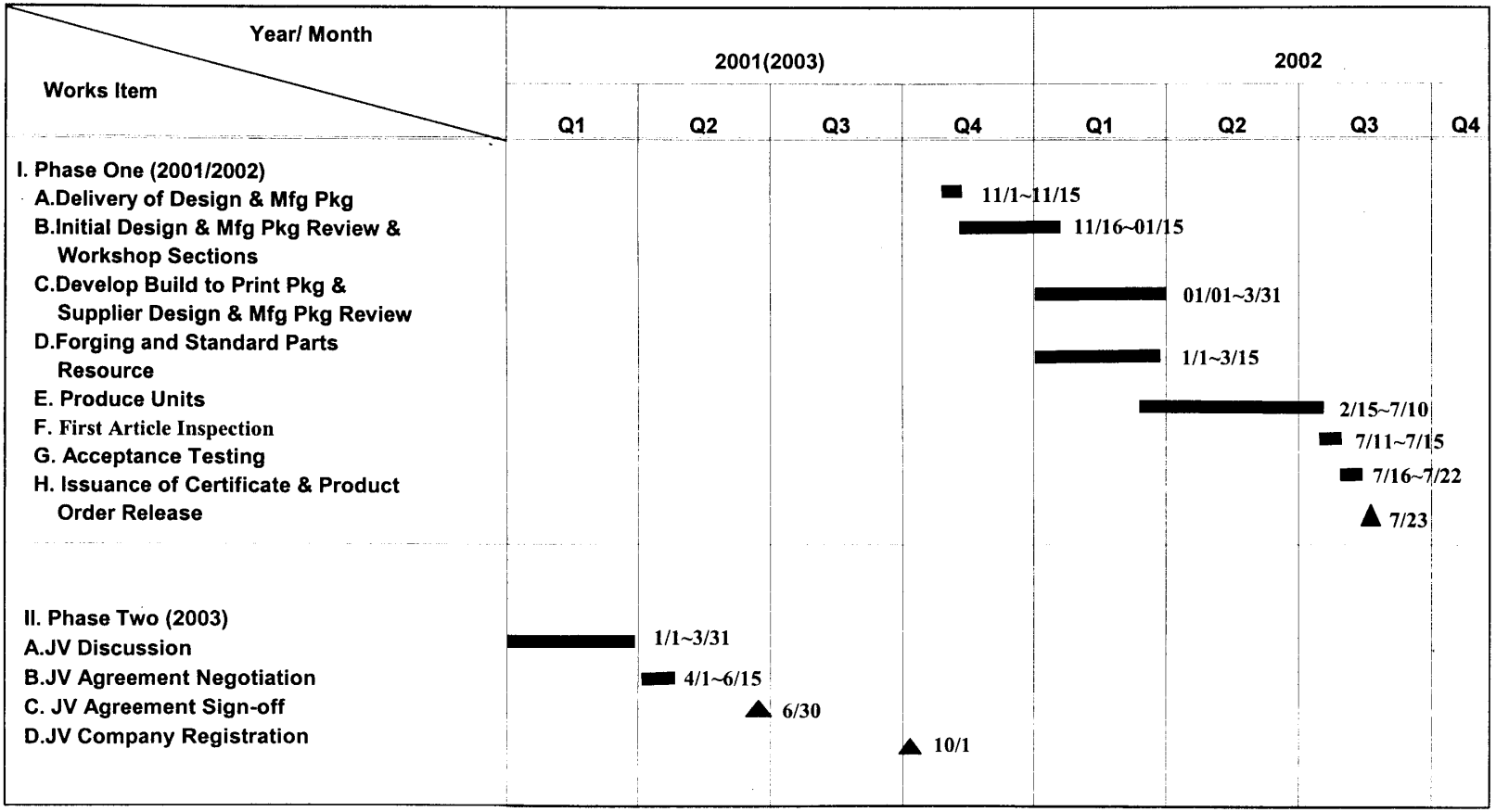
The following commonly-used PRIDE forms are available on-line in the Quality Assurance section of Messier-Dowty-Toronto's Web-Site (**www.messier-dowty.on.ca** username: **supplier**; password: **sd99sugp**). The forms are in both WORD and Adobe file formats:

1. Non-Conformance / Concession Record
2. First Article Inspection Report
3. Supplier Warrant of Material (Front and Continuation Sheets
4. Supplier Query Form
5. Serial Number Requisition Form
6. Sample Part Tag (also available in self-adhesive form, through Messier-Dowty's Supplier Development Dept.)

附件七

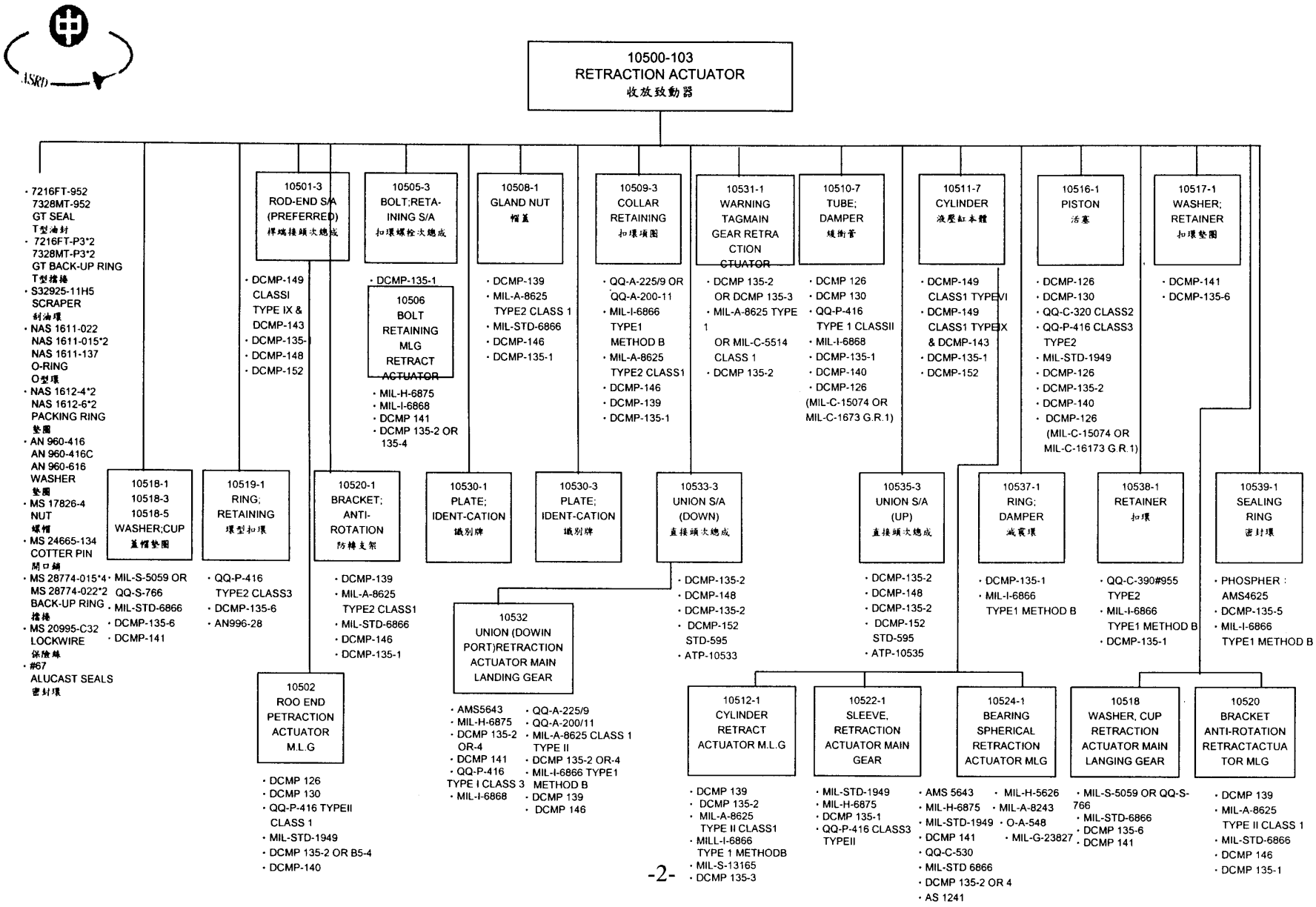
中科院第一研究所向M-D公司簡報之技引案現況資料

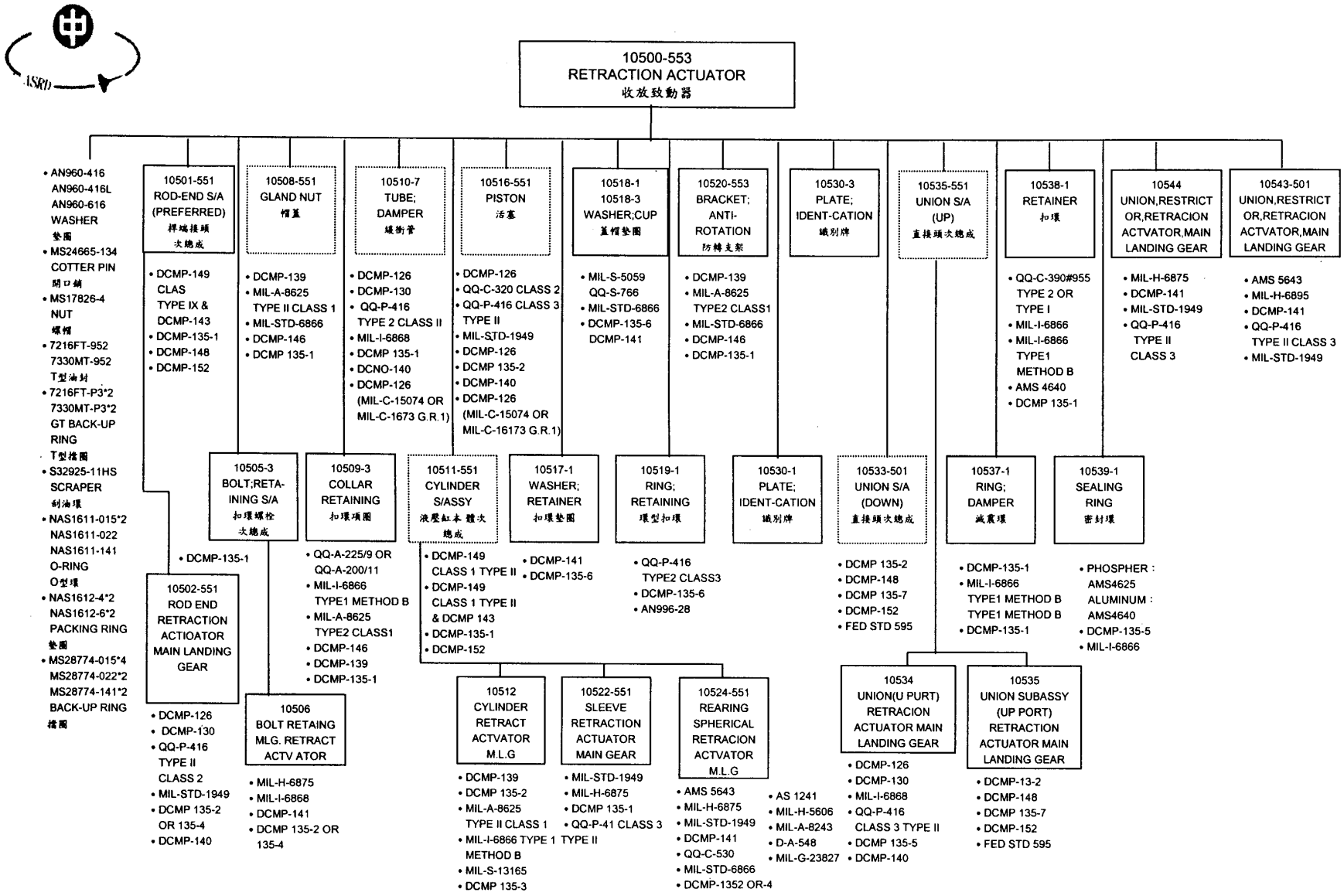
I.DRAFT MASTER SCHEDULE

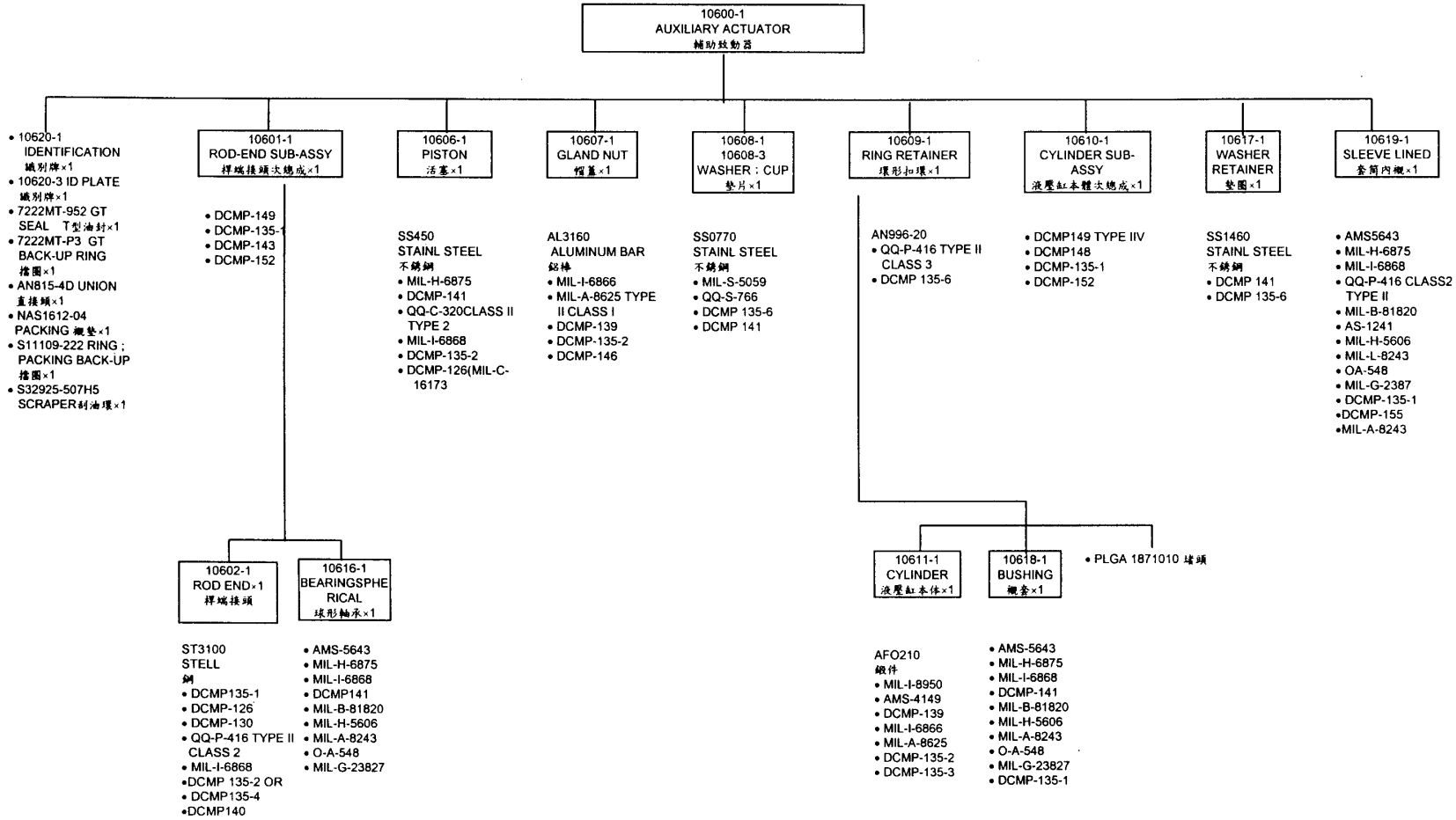


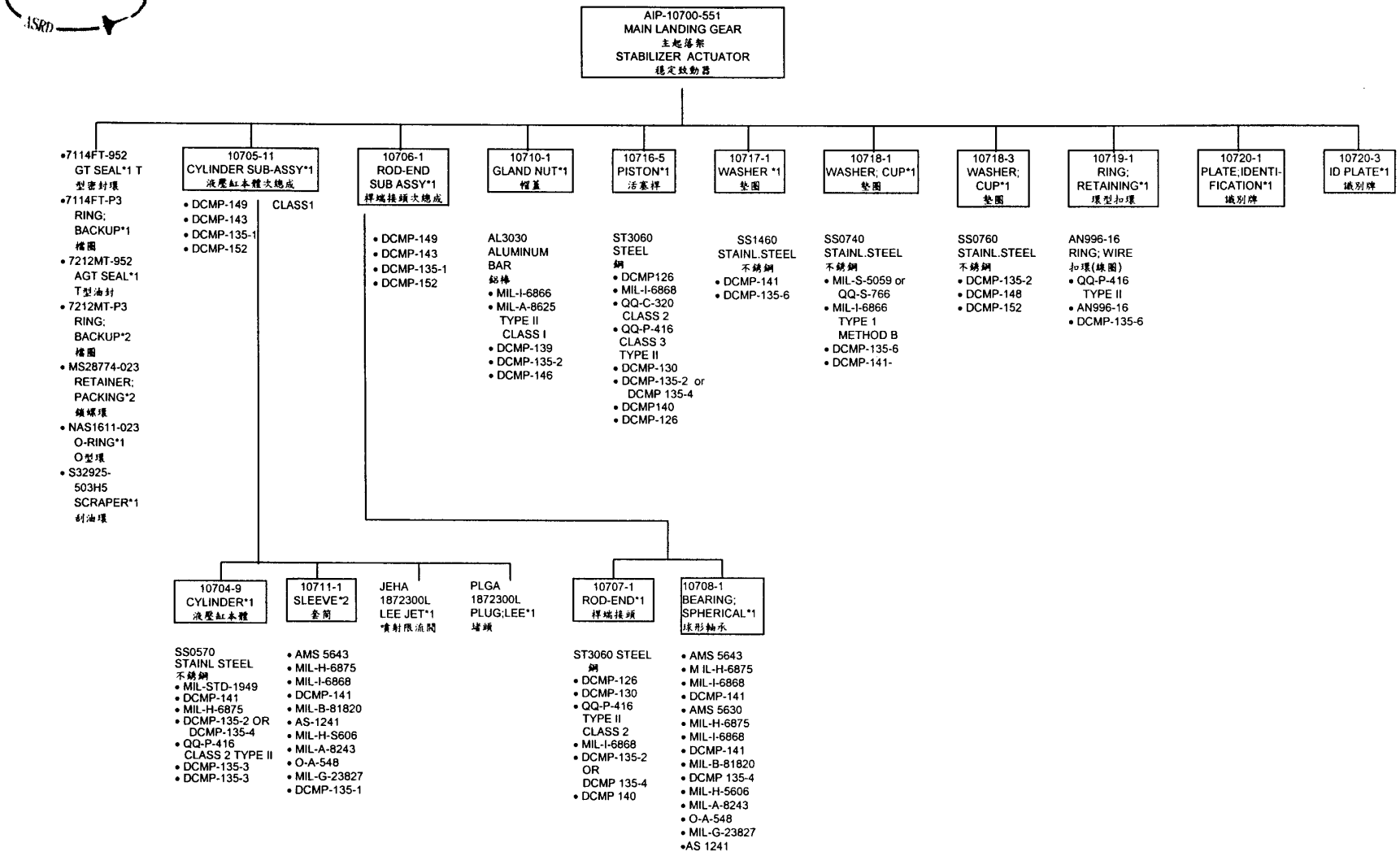
II.Test Fixture

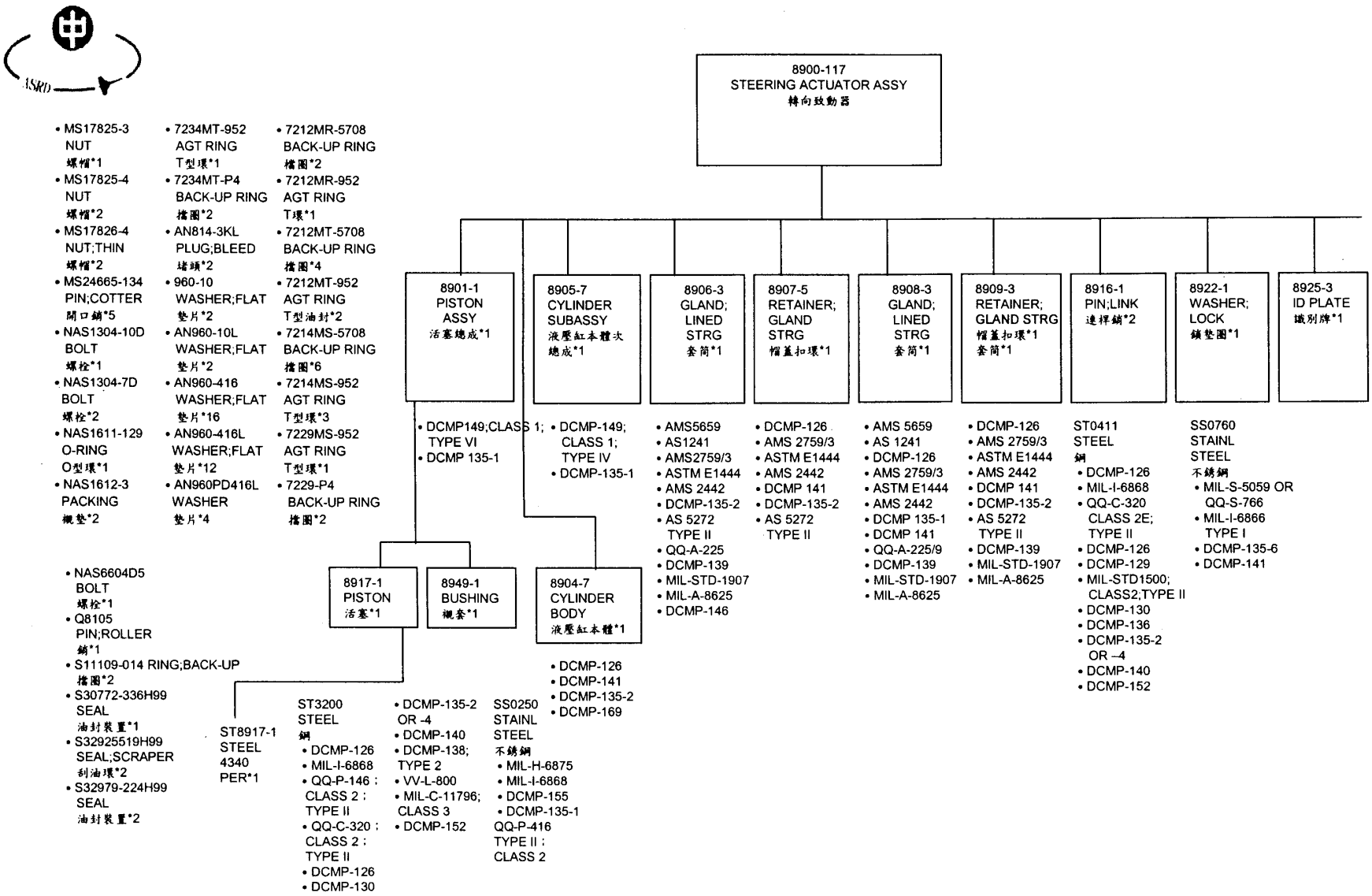
Actuators Assembly No.(致動器型號)	Fixture type(固定座型式)
Retraction Actuator ATP-10500 (收放致動器)	FIXTURE CJ 5026-1D
Auxiliary Actuator ATP-10600 (輔助致動器)	FIXTURE CJ5025-1D
Stabilizer Actuator ATP-10700 (穩定致動器)	FIXTURE CJ5024-1D
Retraction Actuator ATP-8300 (收放致動器)	FIXTURE CJ4968-1D
Drag Strut Actuator ATP-8400 (阻力支撐致動器)	FIXTURE CJ5027-1D
Steering Actuator ATP-8900 (轉向致動器)	FIXTURE CTR 5102-1E FIXTURE CTR 5102-2

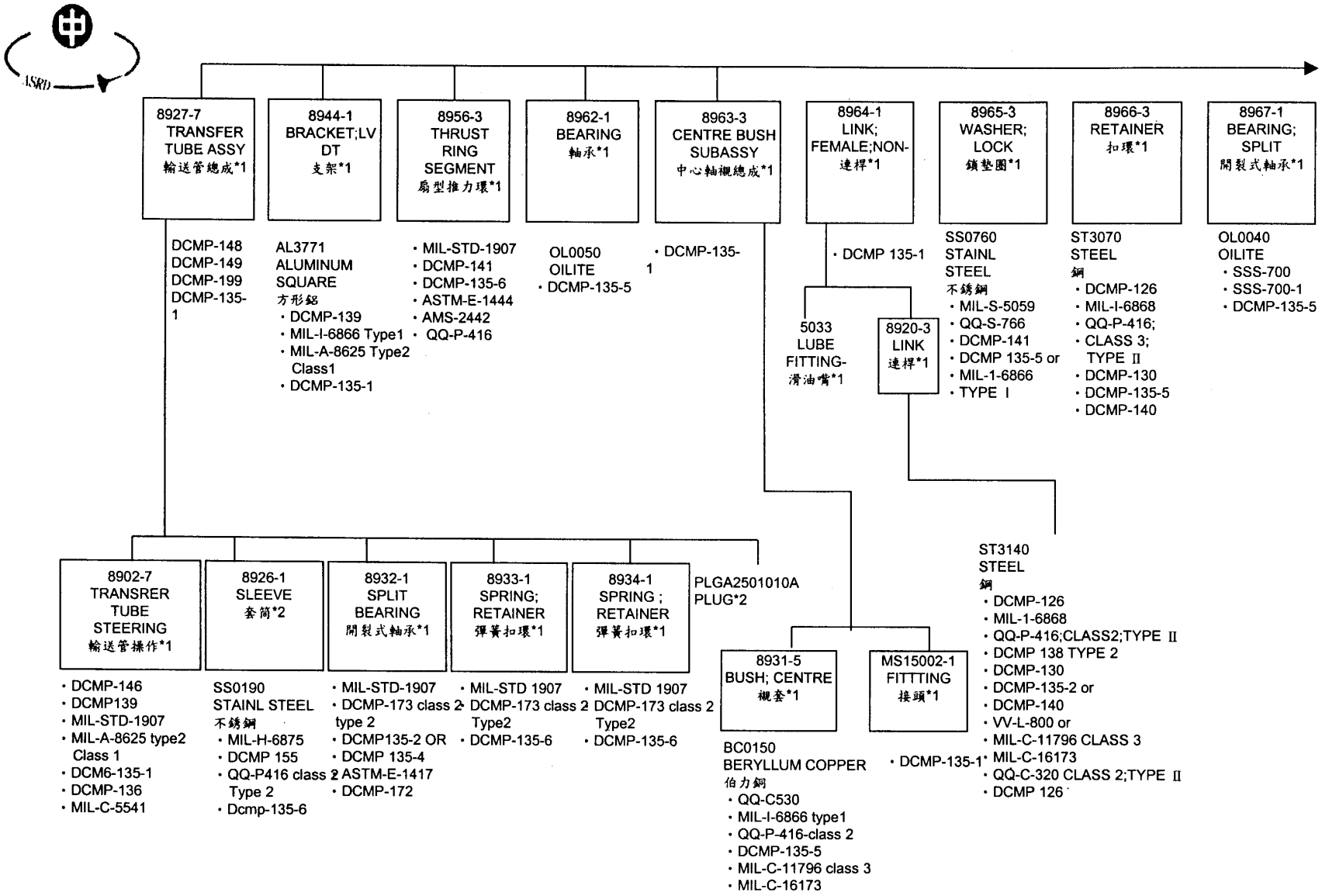

10500-103
RETRACTION ACTUATOR
收放致動器
· 7216FT-952
7328MT-952
GT SEAL
T型油封
· 7216FT-P3*2
7328MT-P3*2
GT BACK-UP RING
T型擋掩
· S32925-11H5
SCRAPER
刮油環
· NAS 1611-022
NAS 1611-015*2
NAS 1611-137
O-RING
O型環
· NAS 1612-4*2
NAS 1612-6*2
PACKING RING
墊圈
· AN 960-416
AN 960-416C
AN 960-616
WASHER
墊圈
· MS 17826-4
NUT
螺帽
· MS 24665-134
COTTER PIN
開口銷
· MS 28774-015*4
MS 28774-022*2
BACK-UP RING
擋掩
· MS 20995-C32
LOCKWIRE
保險絲
· #67
ALUCAST SEALS
密封環
10501-3
ROD-END S/A
(PREFERRED)
桿端接頭次總成
· DCMP-149
CLASSI
TYPE IX &
DCMP-143
· DCMP-135-
· DCMP-148
· DCMP-152
10505-3
BOLT;RETA-
INING S/A
扣環螺栓次總成
· DCMP-135-1
10506
BOLT
RETAINING
MLG
RETRACT
ACTUATOR
· MIL-H-6875
· MIL-I-6868
· DCMP 141
· DCMP 135-2 OR
135-4
10508-1
GLAND NUT
帽蓋
· DCMP-139
· MIL-A-8625
TYPE2 CLASS 1
· MIL-STD-6866
· DCMP-146
· DCMP-135-1
10509-3
COLLAR
RETAINING
扣環填圈
· QQ-A-225/9 OR
QQ-A-200-11
· MIL-I-6866
TYPE1
METHOD B
· MIL-A-8625
TYPE2 CLASS1
· DCMP-146
· DCMP-139
· DCMP-135-1
10531-1
WARNING
TAGMAIN
GEAR RETRA
CTION
CTUATOR
· DCMP 135-2
OR DCMP 135-3
· MIL-A-8625 TYPE
1
OR MIL-C-5514
CLASS 1
· DCMP 135-2
10510-7
TUBE;
DAMPER
緩衝管
· DCMP 126
· DCMP 130
· QQ-P-416
TYPE 1 CLASSII
· MIL-I-6868
· DCMP-135-1
· DCMP-140
· DCMP-126
(MIL-C-15074 OR
MIL-C-1673 G.R.1)
10511-7
CYLINDER
液壓缸本體
· DCMP-149
CLASS1 TYPEVI
· DCMP-149
CLASS1 TYPEX
& DCMP-143
· DCMP-135-1
· DCMP-152
10516-1
PISTON
活塞
· DCMP-126
· DCMP-130
· QQ-C-320 CLASS2
· QQ-P-416 CLASS3
TYPE2
· MIL-STD-1949
· DCMP-126
· DCMP-135-2
· DCMP-140
· DCMP-126
(MIL-C-15074 OR
MIL-C-16173 G.R.1)
10517-1
WASHER;
RETAINER
扣環墊圈
· DCMP-141
· DCMP-135-6
10518-1
10518-3
10518-5
WASHER;CUP
蓋帽墊圈
· MIL-S-5059 OR
QQ-S-766
· MIL-STD-6866
· DCMP-135-6
· DCMP-141
10519-1
RING;
RETAINING
環型扣環
· QQ-P-416
TYPE2 CLASS3
· DCMP-135-6
· AN996-28
10520-1
BRACKET;
ANTI-
ROTATION
防轉支架
· DCMP-139
· MIL-A-8625
TYPE2 CLASS1
· MIL-STD-6866
· DCMP-146
· DCMP-135-1
10530-1
PLATE;
IDENT-CATION
識別牌
10530-3
PLATE;
IDENT-CATION
識別牌
10533-3
UNION S/A
(DOWN)
直接頭次總成
· DCMP-135-2
· DCMP-148
· DCMP-135-2
· DCMP-152
STD-595
· ATP-10533
10535-3
UNION S/A
(UP)
直接頭次總成
· DCMP-135-2
· DCMP-148
· DCMP-135-2
· DCMP-152
STD-595
· ATP-10535
10537-1
RING;
DAMPER
減震環
· DCMP-135-1
· MIL-I-6866
TYPE1 METHOD B
10538-1
RETAINER
扣環
· QQ-C-390#955
TYPE2
· MIL-I-6866
TYPE1 METHOD B
· DCMP-135-1
10539-1
SEALING
RING
密封環
· PHOSPHER :
AMS4625
· DCMP-135-5
· MIL-I-6866
TYPE1 METHOD B
10502
ROO END
PETRACTION
ACTUATOR
M.L.G
· DCMP 126
· DCMP 130
· QQ-P-416 TYPEII
CLASS 1
· MIL-STD-1949
· DCMP 135-2 OR B5-4
· DCMP-140
10532
UNION (DOWIN
PORT)RETRACTION
ACTUATOR MAIN
LANDING GEAR
· AMS5643
· MIL-H-6875
· DCMP 135-2
OR-4
· DCMP 141
· QQ-P-416
TYPE I CLASS 3
· MIL-I-6868
· QQ-A-225/9
· QQ-A-200/11
· MIL-A-8625 CLASS 1
TYPE II
· DCMP 135-2 OR-4
· MIL-I-6866 TYPE1
METHOD B
· DCMP 139
· DCMP 146
10512-1
CYLINDER
RETRACT
ACTUATOR M.L.G
· DCMP 139
· DCMP 135-2
· MIL-A-8625
TYPE II CLASS1
· MILL-I-6866
TYPE 1 METHODB
· MIL-S-13165
· DCMP 135-3
10522-1
SLEEVE,
RETRACTION
ACTUATOR MAIN
GEAR
· MIL-STD-1949
· MIL-H-6875
· DCMP 135-1
· QQ-P-416 CLASS3
TYPEII
10524-1
BEARING
SPHERICAL
RETRACTION
ACTUATOR MLG
· AMS 5643
· MIL-H-6875
· MIL-STD-1949
· DCMP 141
· QQ-C-530
· MIL-STD 6866
· DCMP 135-2 OR 4
· AS 1241
· MIL-H-5626
· MIL-A-8243
· O-A-548
· MIL-G-23827
10518
WASHER, CUP
RETRACTION
ACTUATOR MAIN
LANGING GEAR
· MIL-S-5059 OR QQ-S-
766
· MIL-STD-6866
· DCMP 135-6
· DCMP 141
10520
BRACKET
ANTI-ROTATION
RETRACTACTUA
TOR MLG
· DCMP 139
· MIL-A-8625
TYPE II CLASS 1
· MIL-STD-6866
· DCMP 146
· DCMP 135-1

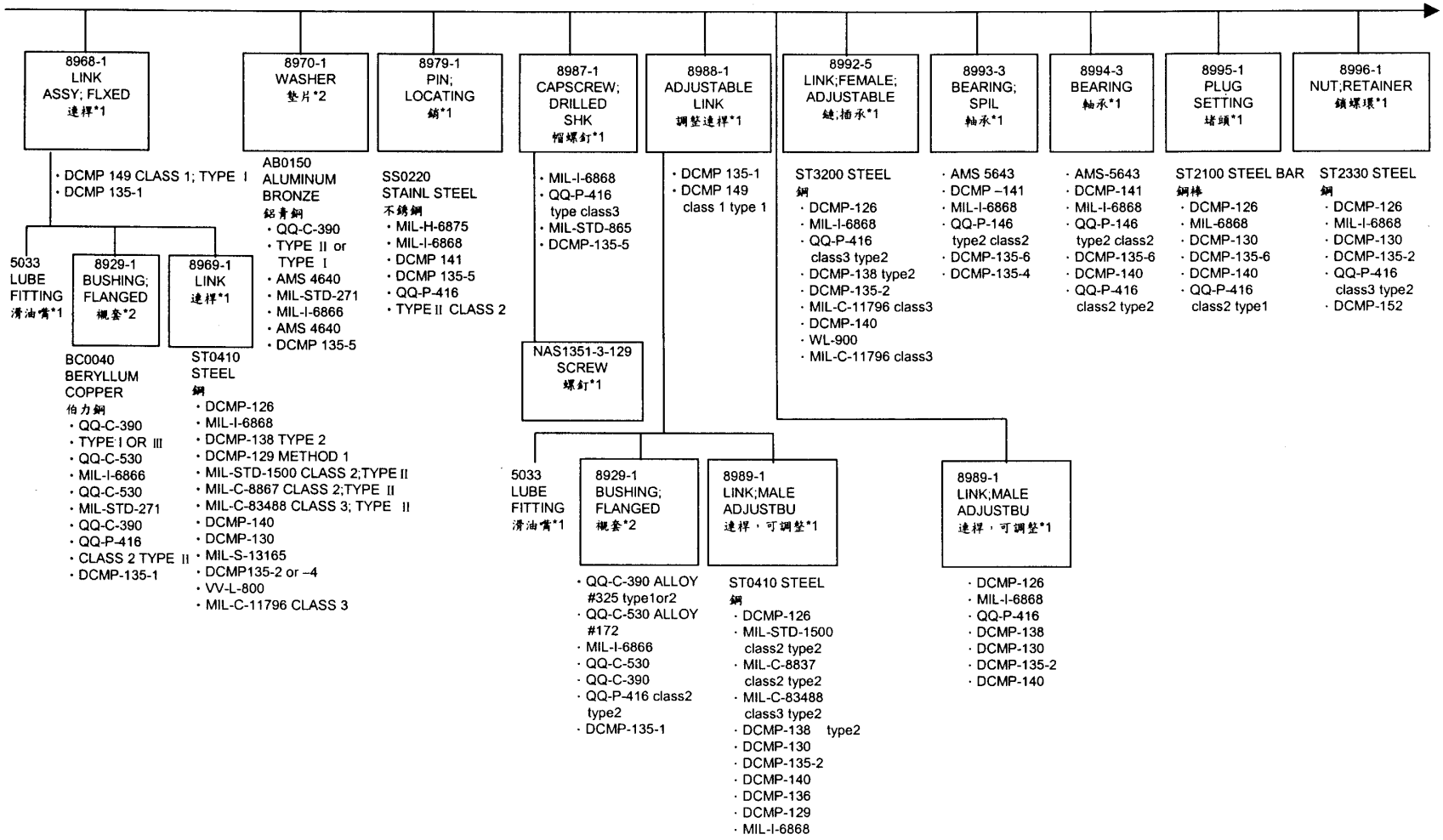

10500-553
RETRACTION ACTUATOR
收放致動器
• AN960-416
AN960-416L
AN960-616
WASHER
墊圈
• MS24665-134
COTTER PIN
開口銷
• MS17826-4
NUT
螺帽
• 7216FT-952
7330MT-952
T型油封
• 7216FT-P3*2
7330MT-P3*2
GT BACK-UP
RING
T型擋圈
• S32925-11HS
SCRAPER
刮油環
• NAS1611-015*2
NAS1611-022
NAS1611-141
O-RING
O型環
• NAS1612-4*2
NAS1612-6*2
PACKING RING
墊圈
• MS28774-015*4
MS28774-022*2
MS28774-141*2
BACK-UP RING
擋圈
10501-551
ROD-END S/A
(PREFERRED)
桿端接頭
次總成
• DCMP-149
CLAS
TYPE IX &
DCMP-143
• DCMP-135-1
• DCMP-148
• DCMP-152
10508-551
GLAND NUT
帽蓋
• DCMP-139
• MIL-A-8625
TYPE II CLASS 1
• MIL-STD-6866
• DCMP-146
• DCMP 135-1
10510-7
TUBE;
DAMPER
緩衝管
• DCMP-126
• DCMP-130
• QQ-P-416
TYPE 2 CLASS II
• MIL-I-6868
• DCMP 135-1
• DCNO-140
• DCMP-126
(MIL-C-15074 OR
MIL-C-1673 G.R.1)
10516-551
PISTON
活塞
• DCMP-126
• QQ-C-320 CLASS 2
• QQ-P-416 CLASS 3
TYPE II
• MIL-STD-1949
• DCMP-126
• DCMP 135-2
• DCMP-140
• DCMP-126
(MIL-C-15074 OR
MIL-C-16173 G.R.1)
10518-1
10518-3
WASHER;CUP
蓋帽墊圈
• MIL-S-5059
QQ-S-766
• MIL-STD-6866
• DCMP-135-6
DCMP-141
10520-553
BRACKET;
ANTI-
ROTATION
防轉支架
• DCMP-139
• MIL-A-8625
TYPE2 CLASS1
• MIL-STD-6866
• DCMP-146
• DCMP-135-1
10530-3
PLATE;
IDENT-CATION
識別牌
10535-551
UNION S/A
(UP)
直接頭次總成
10538-1
RETAINER
扣環
• QQ-C-390#955
TYPE 2 OR
TYPE I
• MIL-I-6866
• MIL-I-6866
TYPE1
METHOD B
• AMS 4640
• DCMP 135-1
10544
UNION,RESTRICT
OR,RETRACION
ACTVATOR,MAIN
LANDING GEAR
• MIL-H-6875
• DCMP-141
• MIL-STD-1949
• QQ-P-416
TYPE II
CLASS 3
10543-501
UNION,RESTRICT
OR,RETRACION
ACTVATOR,MAIN
LANDING GEAR
• AMS 5643
• MIL-H-6895
• DCMP-141
• QQ-P-416
TYPE II CLASS 3
• MIL-STD-1949
10505-3
BOLT;RETA-
INING S/A
扣環螺栓
次總成
10509-3
COLLAR
RETAINING
扣環項圈
10511-551
CYLINDER
S/ASSY
液壓缸本體次
總成
10517-1
WASHER;
RETAINER
扣環墊圈
10519-1
RING;
RETAINING
環型扣環
10530-1
PLATE;
IDENT-CATION
識別牌
10533-501
UNION S/A
(DOWN)
直接頭次總成
10537-1
RING;
DAMPER
減震環
10539-1
SEALING
RING
密封環
• DCMP-135-1
10502-551
ROD END
RETRACTION
ACTIOATOR
MAIN LANDING
GEAR
• DCMP-126
• DCMP-130
• QQ-P-416
TYPE II
CLASS 2
• MIL-STD-1949
• DCMP 135-2
OR 135-4
• DCMP-140
10506
BOLT RETAING
MLG. RETRACT
ACTV ATOR
• MIL-H-6875
• MIL-I-6868
• DCMP-141
• DCMP 135-2 OR
135-4
• QQ-A-225/9 OR
QQ-A-200/11
• MIL-I-6866
TYPE1 METHOD B
• MIL-A-8625
TYPE2 CLASS1
• DCMP-146
• DCMP-139
• DCMP-135-1
• DCMP-149
CLASS 1 TYPE II
• DCMP-149
CLASS 1 TYPE II
& DCMP 143
• DCMP-135-1
• DCMP-152
• DCMP-141
• DCMP-135-6
• QQ-P-416
TYPE2 CLASS3
• DCMP-135-6
• AN996-28
• DCMP 135-2
• DCMP-148
• DCMP 135-7
• DCMP-152
• FED STD 595
• DCMP-135-1
• MIL-I-6866
TYPE1 METHOD B
TYPE1 METHOD B
• DCMP-135-1
• PHOSPHER :
AMS4625
ALUMINUM :
AMS4640
• DCMP-135-5
• MIL-I-6866
10512
CYLINDER
RETRACT
ACTVATOR
M.L.G
• DCMP-139
• DCMP 135-2
• MIL-A-8625
TYPE II CLASS 1
• MIL-I-6866 TYPE 1
METHOD B
• MIL-S-13165
• DCMP 135-3
10522-551
SLEEVE
RETRACTION
ACTUATOR
MAIN GEAR
• MIL-STD-1949
• MIL-H-6875
• DCMP 135-1
• QQ-P-41 CLASS 3
TYPE II
10524-551
REARING
SPHERICAL
RETRACION
ACTVATOR
M.L.G
• AMS 5643
• MIL-H-6875
• MIL-STD-1949
• DCMP-141
• QQ-C-530
• MIL-STD-6866
• DCMP-1352 OR-4
• AS 1241
• MIL-H-5606
• MIL-A-8243
• D-A-548
• MIL-G-23827
10534
UNION(U PURT)
RETRACION
ACTUATOR MAIN
LANDING GEAR
• DCMP-126
• DCMP-130
• MIL-I-6868
• QQ-P-416
CLASS 3 TYPE II
• DCMP 135-5
• DCMP-140
10535
UNION SUBASSY
(UP PORT)
RETRACTION
ACTUATOR MAIN
LANDING GEAR
• DCMP-13-2
• DCMP-148
• DCMP 135-7
• DCMP-152
• FED STD 595


10600-1
AUXILIARY ACTUATOR
輔助致動器
• 10620-1
IDENTIFICATION
識別牌×1
• 10620-3 ID PLATE
識別牌×1
• 7222MT-952 GT
SEAL T型油封×1
• 7222MT-P3 GT
BACK-UP RING
擋圈×1
• AN815-4D UNION
直接頭×1
• NAS1612-04
PACKING 襯墊×1
• S11109-222 RING ;
PACKING BACK-UP
擋圈×1
• S32925-507H5
SCRAPER刮油環×1
10601-1
ROD-END SUB-ASSY
桿端接頭次總成×1
• DCMP-149
• DCMP-135-1
• DCMP-143
• DCMP-152
10606-1
PISTON
活塞×1
SS450
STAINL STEEL
不銹鋼
• MIL-H-6875
• DCMP-141
• QQ-C-320CLASS II
TYPE 2
• MIL-I-6868
• DCMP-135-2
• DCMP-126(MIL-C-
16173
10607-1
GLAND NUT
帽蓋×1
AL3160
ALUMINUM BAR
鋁棒
• MIL-I-6866
• MIL-A-8625 TYPE
II CLASS I
• DCMP-139
• DCMP-135-2
• DCMP-146
10608-1
10608-3
WASHER : CUP
墊片×1
SS0770
STAINL STEEL
不銹鋼
• MIL-S-5059
• QQ-S-766
• DCMP 135-6
• DCMP 141
10609-1
RING RETAINER
環形扣環×1
AN996-20
• QQ-P-416 TYPE II
CLASS 3
• DCMP 135-6
10610-1
CYLINDER SUB-
ASSY
液壓缸本體次總成×1
• DCMP149 TYPE IIV
• DCMP148
• DCMP-135-1
• DCMP-152
10617-1
WASHER
RETAINER
墊圈×1
SS1460
STAINL STEEL
不銹鋼
• DCMP 141
• DCMP 135-6
10619-1
SLEEVE LINED
套筒內襯×1
• AMS5643
• MIL-H-6875
• MIL-I-6868
• QQ-P-416 CLASS2
TYPE II
• MIL-B-81820
• AS-1241
• MIL-H-5606
• MIL-L-8243
• OA-548
• MIL-G-2387
• DCMP-135-1
•DCMP-155
•MIL-A-8243
10602-1
ROD END×1
桿端接頭
ST3100
STELL
鋼
• DCMP135-1
• DCMP-126
• DCMP-130
• QQ-P-416 TYPE II
CLASS 2
• MIL-I-6868
•DCMP 135-2 OR
• DCMP135-4
•DCMP140
10616-1
BEARINGSPHE
RICAL
球形軸承×1
• AMS-5643
• MIL-H-6875
• MIL-I-6868
• DCMP141
• MIL-B-81820
• MIL-H-5606
• MIL-A-8243
• O-A-548
• MIL-G-23827
10611-1
CYLINDER
液壓缸本体×1
AFO210
鍛件
• MIL-I-8950
• AMS-4149
• DCMP-139
• MIL-I-6866
• MIL-A-8625
• DCMP-135-2
• DCMP-135-3
10618-1
BUSHING
襯套×1
• AMS-5643
• MIL-H-6875
• MIL-I-6868
• DCMP-141
• MIL-B-81820
• MIL-H-5606
• MIL-A-8243
• O-A-548
• MIL-G-23827
• DCMP-135-1
• PLGA 1871010 堵頭


AIP-10700-551
MAIN LANDING GEAR
主起落架
STABILIZER ACTUATOR
穩定致動器
•7114FT-952
GT SEAL*1 T
型密封環
•7114FT-P3
RING;
BACKUP*1
檔圈
• 7212MT-952
AGT SEAL*1
T型油封
• 7212MT-P3
RING;
BACKUP*2
檔圈
• MS28774-023
RETAINER;
PACKING*2
鎖螺環
• NAS1611-023
O-RING*1
O型環
• S32925-
503H5
SCRAPER*1
刮油環
10705-11
CYLINDER SUB-ASSY*1
液壓缸本體次總成
• DCMP-149
• DCMP-143
• DCMP-135-1
• DCMP-152
CLASS1
10706-1
ROD-END
SUB ASSY*1
桿端接頭次總成
• DCMP-149
• DCMP-143
• DCMP-135-1
• DCMP-152
10710-1
GLAND NUT*1
帽蓋
AL3030
ALUMINUM
BAR
鋁棒
• MIL-I-6866
• MIL-A-8625
TYPE II
CLASS I
• DCMP-139
• DCMP-135-2
• DCMP-146
10716-5
PISTON*1
活塞桿
ST3060
STEEL
鋼
• DCMP126
• MIL-I-6868
• QQ-C-320
CLASS 2
• QQ-P-416
CLASS 3
TYPE II
• DCMP-130
• DCMP-135-2 or
DCMP 135-4
• DCMP140
• DCMP-126
10717-1
WASHER *1
墊圈
SS1460
STAINL.STEEL
不銹鋼
• DCMP-141
• DCMP-135-6
10718-1
WASHER; CUP*1
墊圈
SS0740
STAINL.STEEL
不銹鋼
• MIL-S-5059 or
QQ-S-766
• MIL-I-6866
TYPE 1
METHOD B
• DCMP-135-6
• DCMP-141-
10718-3
WASHER;
CUP*1
墊圈
SS0760
STAINL.STEEL
不銹鋼
• DCMP-135-2
• DCMP-148
• DCMP-152
10719-1
RING;
RETAINING*1
環型扣環
AN996-16
RING; WIRE
扣環(線圈)
• QQ-P-416
TYPE II
• AN996-16
• DCMP-135-6
10720-1
PLATE,IDENTI-
FICATION*1
識別牌
10720-3
ID PLATE*1
識別牌
10704-9
CYLINDER*1
液壓缸本體
SS0570
STAINL STEEL
不銹鋼
• MIL-STD-1949
• DCMP-141
• MIL-H-6875
• DCMP-135-2 OR
DCMP-135-4
• QQ-P-416
CLASS 2 TYPE II
• DCMP-135-3
• DCMP-135-3
10711-1
SLEEVE*2
套筒
• AMS 5643
• MIL-H-6875
• MIL-I-6868
• DCMP-141
• MIL-B-81820
• AS-1241
• MIL-H-S606
• MIL-A-8243
• O-A-548
• MIL-G-23827
• DCMP-135-1
JEHA
1872300L
LEE JET*1
噴射限流閥
PLGA
1872300L
PLUG;LEE*1
堵頭
10707-1
ROD-END*1
桿端接頭
ST3060 STEEL
鋼
• DCMP-126
• DCMP-130
• QQ-P-416
TYPE II
CLASS 2
• MIL-I-6868
• DCMP-135-2
OR
DCMP 135-4
• DCMP 140
10708-1
BEARING;
SPHERICAL*1
球形軸承
• AMS 5643
• M IL-H-6875
• MIL-I-6868
• DCMP-141
• AMS 5630
• MIL-H-6875
• MIL-I-6868
• DCMP-141
• MIL-B-81820
• DCMP 135-4
• MIL-H-5606
• MIL-A-8243
• O-A-548
• MIL-G-23827
•AS 1241


8900-117
STEERING ACTUATOR ASSY
轉向致動器
8901-1
PISTON
ASSY
活塞總成*1
8905-7
CYLINDER
SUBASSY
液壓缸本體次
總成*1
8906-3
GLAND;
LINED
STRG
套筒*1
8907-5
RETAINER;
GLAND
STRG
帽蓋扣環*1
8908-3
GLAND;
LINED
STRG
套筒*1
8909-3
RETAINER;
GLAND STRG
帽蓋扣環*1
套筒*1
8916-1
PIN;LINK
連桿銷*2
8922-1
WASHER;
LOCK
鎖墊圈*1
8925-3
ID PLATE
識別牌*1
• MS17825-3
NUT
螺帽*1
• MS17825-4
NUT
螺帽*2
• MS17826-4
NUT;THIN
螺帽*2
• MS24665-134
PIN;COTTER
開口銷*5
• NAS1304-10D
BOLT
螺栓*1
• NAS1304-7D
BOLT
螺栓*2
• NAS1611-129
O-RING
O型環*1
• NAS1612-3
PACKING
襯墊*2
• 7234MT-952
AGT RING
T型環*1
• 7234MT-P4
BACK-UP RING
擋圈*2
• AN814-3KL
PLUG;BLEED
堵頭*2
• 960-10
WASHER;FLAT
墊片*2
• AN960-10L
WASHER;FLAT
墊片*2
• AN960-416
WASHER;FLAT
墊片*16
• AN960-416L
WASHER;FLAT
墊片*12
• AN960PD416L
WASHER
墊片*4
• 7212MR-5708
BACK-UP RING
擋圈*2
• 7212MR-952
AGT RING
T環*1
• 7212MT-5708
BACK-UP RING
擋圈*4
• 7212MT-952
AGT RING
T型油封*2
• 7214MS-5708
BACK-UP RING
擋圈*6
• 7214MS-952
AGT RING
T型環*3
• 7229MS-952
AGT RING
T型環*1
• 7229-P4
BACK-UP RING
擋圈*2
• DCMP149;CLASS 1;
TYPE VI
• DCMP 135-1
• DCMP-149;
CLASS 1;
TYPE IV
• DCMP-135-1
• AMS5659
• AS1241
• AMS2759/3
• ASTM E1444
• AMS 2442
• DCMP-135-2
• AS 5272
TYPE II
• QQ-A-225
• DCMP-139
• MIL-STD-1907
• MIL-A-8625
• DCMP-146
• DCMP-126
• AMS 2759/3
• ASTM E1444
• AMS 2442
• DCMP 141
• DCMP-135-2
• AS 5272
TYPE II
• AMS 5659
• AS 1241
• DCMP-126
• AMS 2759/3
• ASTM E1444
• AMS 2442
• DCMP 135-1
• DCMP 141
• QQ-A-225/9
• DCMP-139
• MIL-STD-1907
• MIL-A-8625
• DCMP-126
• AMS 2759/3
• ASTM E1444
• AMS 2442
• DCMP 141
• DCMP-135-2
• AS 5272
TYPE II
• DCMP-139
• MIL-STD-1907
• MIL-A-8625
ST0411
STEEL
鋼
• DCMP-126
• MIL-I-6868
• QQ-C-320
CLASS 2E;
TYPE II
• DCMP-126
• DCMP-129
• MIL-STD1500;
CLASS2;TYPE II
• DCMP-130
• DCMP-136
• DCMP-135-2
OR –4
• DCMP-140
• DCMP-152
SS0760
STAINL
STEEL
不銹鋼
• MIL-S-5059 OR
QQ-S-766
• MIL-I-6866
TYPE I
• DCMP-135-6
• DCMP-141
8917-1
PISTON
活塞*1
8949-1
BUSHING
襯套*1
8904-7
CYLINDER
BODY
液壓缸本體*1
• NAS6604D5
BOLT
螺栓*1
• Q8105
PIN;ROLLER
銷*1
• S11109-014 RING;BACK-UP
擋圈*2
• S30772-336H99
SEAL
油封裝置*1
• S32925519H99
SEAL;SCRAPER
刮油環*2
• S32979-224H99
SEAL
油封裝置*2
ST8917-1
STEEL
4340
PER*1
ST3200
STEEL
鋼
• DCMP-126
• MIL-I-6868
• QQ-P-146；
CLASS 2；
TYPE II
• QQ-C-320；
CLASS 2；
TYPE II
• DCMP-126
• DCMP-130
• DCMP-135-2
OR -4
• DCMP-140
• DCMP-138;
TYPE 2
• VV-L-800
• MIL-C-11796;
CLASS 3
• DCMP-152
SS0250
STAINL
STEEL
不銹鋼
• MIL-H-6875
• MIL-I-6868
• DCMP-155
• DCMP-135-1
QQ-P-416
TYPE II；
CLASS 2
• DCMP-126
• DCMP-141
• DCMP-135-2
• DCMP-169


8927-7
TRANSFER TUBE ASSY
輸送管總成*1
DCMP-148
DCMP-149
DCMP-199
DCMP-135-1
8944-1
BRACKET;LVDT
支架*1
AL3771
ALUMINUM
SQUARE
方形鋁
· DCMP-139
· MIL-I-6866 Type1
· MIL-A-8625 Type2 Class1
· DCMP-135-1
8956-3
THRUST RING SEGMENT
扇型推力環*1
· MIL-STD-1907
· DCMP-141
· DCMP-135-6
· ASTM-E-1444
· AMS-2442
· QQ-P-416
8962-1
BEARING
軸承*1
OL0050
OILITE
· DCMP-135-5
8963-3
CENTRE BUSH SUBASSY
中心軸襯總成*1
· DCMP-135-1
8964-1
LINK; FEMALE;NON-
連桿*1
· DCMP 135-1
5033
LUBE FITTING-
滑油嘴*1
8920-3
LINK
連桿*1
8965-3
WASHER; LOCK
鎖墊圈*1
SS0760
STAINL STEEL
不銹鋼
· MIL-S-5059
· QQ-S-766
· DCMP-141
· DCMP 135-5 or
· MIL-1-6866
· TYPE I
8966-3
RETAINER
扣環*1
ST3070
STEEL
鋼
· DCMP-126
· MIL-I-6868
· QQ-P-416;
· CLASS 3;
TYPE II
· DCMP-130
· DCMP-135-5
· DCMP-140
8967-1
BEARING; SPLIT
開製式軸承*1
OL0040
OILITE
· SSS-700
· SSS-700-1
· DCMP-135-5
8902-7
TRANSRER TUBE STEERING
輸送管操作*1
· DCMP-146
· DCMP139
· MIL-STD-1907
· MIL-A-8625 type2 Class 1
· DCM6-135-1
· DCMP-136
· MIL-C-5541
8926-1
SLEEVE
套筒*2
SS0190
STAINL STEEL
不銹鋼
· MIL-H-6875
· DCMP 155
· QQ-P416 class 2 Type 2
· Dcmp-135-6
8932-1
SPLIT BEARING
開製式軸承*1
· MIL-STD-1907
· DCMP-173 class 2 type 2
· DCMP135-2 OR
· DCMP 135-4
· ASTM-E-1417
· DCMP-172
8933-1
SPRING; RETAINER
彈簧扣環*1
· MIL-STD 1907
DCMP-173 class 2 Type2
· DCMP-135-6
8934-1
SPRING ; RETAINER
彈簧扣環*1
· MIL-STD 1907
DCMP-173 class 2 Type2
· DCMP-135-6
PLGA2501010A
PLUG*2
8931-5
BUSH; CENTRE
襯套*1
BC0150
BERYLLUM COPPER
伯力銅
· QQ-C530
· MIL-I-6866 type1
· QQ-P-416-class 2
· DCMP-135-5
· MIL-C-11796 class 3
· MIL-C-16173
MS15002-1
FITTTING
接頭*1
· DCMP-135-1
ST3140
STEEL
鋼
· DCMP-126
· MIL-1-6868
· QQ-P-416;CLASS2;TYPE II
· DCMP 138 TYPE 2
· DCMP-130
· DCMP-135-2 or
· DCMP-140
· VV-L-800 or
· MIL-C-11796 CLASS 3
· MIL-C-16173
· QQ-C-320 CLASS 2;TYPE II
· DCMP 126


8968-1
LINK
ASSY; FLXED
連桿*1
· DCMP 149 CLASS 1; TYPE I
· DCMP 135-1
5033
LUBE
FITTING
滑油嘴*1
8929-1
BUSHING;
FLANGED
襯套*2
BC0040
BERYLLUM
COPPER
伯力鋼
· QQ-C-390
· TYPE I OR III
· QQ-C-530
· MIL-I-6866
· QQ-C-530
· MIL-STD-271
· QQ-C-390
· QQ-P-416
· CLASS 2 TYPE II
· DCMP-135-1
8969-1
LINK
連桿*1
ST0410
STEEL
鋼
· DCMP-126
· MIL-I-6868
· DCMP-138 TYPE 2
· DCMP-129 METHOD 1
· MIL-STD-1500 CLASS 2;TYPE II
· MIL-C-8867 CLASS 2;TYPE II
· MIL-C-83488 CLASS 3; TYPE II
· DCMP-140
· DCMP-130
· MIL-S-13165
· DCMP135-2 or –4
· VV-L-800
· MIL-C-11796 CLASS 3
8970-1
WASHER
墊片*2
AB0150
ALUMINUM
BRONZE
鋁青銅
· QQ-C-390
· TYPE II or
TYPE I
· AMS 4640
· MIL-STD-271
· MIL-I-6866
· AMS 4640
· DCMP 135-5
8979-1
PIN;
LOCATING
銷*1
SS0220
STAINL STEEL
不銹鋼
· MIL-H-6875
· MIL-I-6868
· DCMP 141
· DCMP 135-5
· QQ-P-416
· TYPE II CLASS 2
8987-1
CAPSCREW;
DRILLED
SHK
帽螺釘*1
· MIL-I-6868
· QQ-P-416
type class3
· MIL-STD-865
· DCMP-135-5
NAS1351-3-129
SCREW
螺釘*1
5033
LUBE
FITTING
滑油嘴*1
8929-1
BUSHING;
FLANGED
襯套*2
· QQ-C-390 ALLOY
#325 type1or2
· QQ-C-530 ALLOY
#172
· MIL-I-6866
· QQ-C-530
· QQ-C-390
· QQ-P-416 class2
type2
· DCMP-135-1
8989-1
LINK;MALE
ADJUSTBU
連桿，可調整*1
ST0410 STEEL
鋼
· DCMP-126
· MIL-STD-1500
class2 type2
· MIL-C-8837
class2 type2
· MIL-C-83488
class3 type2
· DCMP-138 type2
· DCMP-130
· DCMP-135-2
· DCMP-140
· DCMP-136
· DCMP-129
· MIL-I-6868
8988-1
ADJUSTABLE
LINK
調整連桿*1
· DCMP 135-1
· DCMP 149
class 1 type 1
8989-1
LINK;MALE
ADJUSTBU
連桿，可調整*1
· DCMP-126
· MIL-I-6868
· QQ-P-416
· DCMP-138
· DCMP-130
· DCMP-135-2
· DCMP-140
8992-5
LINK;FEMALE;
ADJUSTABLE
鏈,插承*1
ST3200 STEEL
鋼
· DCMP-126
· MIL-I-6868
· QQ-P-416
class3 type2
· DCMP-138 type2
· DCMP-135-2
· MIL-C-11796 class3
· DCMP-140
· WL-900
· MIL-C-11796 class3
8993-3
BEARING;
SPIL
軸承*1
· AMS 5643
· DCMP –141
· MIL-I-6868
· QQ-P-146
type2 class2
· DCMP-135-6
· DCMP-135-4
8994-3
BEARING
軸承*1
· AMS-5643
· DCMP-141
· MIL-I-6868
· QQ-P-146
type2 class2
· DCMP-135-6
· DCMP-140
· QQ-P-416
class2 type2
8995-1
PLUG
SETTING
堵頭*1
ST2100 STEEL BAR
鋼棒
· DCMP-126
· MIL-6868
· DCMP-130
· DCMP-135-6
· DCMP-140
· QQ-P-416
class2 type1
8996-1
NUT;RETAINER
鎖螺環*1
ST2330 STEEL
鋼
· DCMP-126
· MIL-I-6868
· DCMP-130
· DCMP-135-2
· QQ-P-416
class3 type2
· DCMP-152

起落架致動器零件特殊製程清冊
(ACTUATOR PART SPECIAL PROCESSES LIST)

類型(TYPE)	零件名稱(DESCRIPTION)	(1)珠擊	(2)鍍鎘	(3)鍍硬鉻	(4)液滲檢驗	(5)磁粒檢驗	(6)熱處理	(7)陽極處理	備註
8300-101 收放致動器 (Retraction Actuator)	8306 墊圈(WASHER ANTI-ROOL)				◎			◎	
	8308 桿端(ROD END)		◎			◎	◎		
	8309 緩衝管(TUBE DAMPER)		◎			◎	◎		
	8310 活塞(PISTON)		◎	◎		◎	◎		
	8312 帽蓋(GLAND)				◎			◎	
	8316 環形扣環(RETAINING RING)		◎						
	8316 環型扣環(RING；RETAINING)		◎						
	8317 墊片(WASHER)				◎				
	8318 螺帽扣環(NUT-RETAINPER)				◎			◎	
	8319 液壓缸本體(CYLINDER)	◎							
	8320 (CYLINDER)					◎		◎	
	8321 墊圈(WASHER LOCK)				◎				
	8322 傳送管(TRANSFER TUBE)				◎				
	8323 墊圈(WASHER)		◎			◎			
	8326 減震環(RING DAMPER)				◎				
	8327 BEARING SPHERICAL		◎			◎			
	8332 (UNION; RETRACTION)				◎				
8400-105 阻力支撐致動器 (Drag Strut Actuator)	8401 液壓缸本體(CYLINDER)	◎			◎				
	8406 活塞(PISTON)		◎	◎		◎	◎		
	8407 帽蓋(GLAND)				◎			◎	
	8408 墊圈(WASHER)				◎				
	8409 環型扣環(RING；RETAINING)		◎						
	8411 桿端接頭(ROD-END)		◎			◎	◎		
	8416 墊圈(WASHER)				◎				
	8418 球形軸承(SPHERICAL BEARING)					◎			
	8422 直接頭(UNION)				◎				

起落架致動器零件特殊製程清冊
(ACTUATOR PART SPECIAL PROCESSES LIST)

類型(TYPE)	零件名稱(DESCRIPTION)	(1)珠擊 SHOT PEENING	(2)鍍鎘 CADMIUM PLATING	(3)鍍硬鉻 HARD CHROMIUM PLATING	(4)液滲檢驗 PENTRANT INSPECT	(5)磁粒檢驗 MAGNETIC PARTICLE INSPECT	(6)熱處理 HEAT TREAT	(7)陽極處理 ANODIZE	備註 NOTE
8900-115 轉向致動器 (Streering Actuator)	8902 轉向傳送管(TRANSFER TUBE)	◎						◎	
	8905 液壓缸本體(CYLINDER)	◎							
	8908 套筒(GLAND, NUT)							◎	
	8909 帽蓋扣環(RETAINER)							◎	
	8916 連桿銷(PIN；LINK)			◎		◎	◎		
	8917 活塞(PISTON)		◎	◎		◎	◎		
	8920 連桿(LINK)		◎	◎	◎		◎		
	8922 鎖墊圈(WASHER LOCK)				◎				
	8926 套筒(SLEEVE)		◎						
	8929 襯套(BUSHING)		◎		◎				
	8931 襯套(BUSH)		◎		◎				
	8932 開裂式軸承(BEARING；SPLIT)		◎						DCMP172
	8933 彈簧扣環(SPRING；RETAINING)		◎						DCMP173
	8944 支架(BRACKET)				◎			◎	
	8949 襯套(BUSH)		◎			◎			
	8956 扇形推力環(THRUST RING)		◎						
	8966 扣環(RETAINING)		◎		◎	◎			
	8979 銷(PIN)		◎			◎			
	8987 螺帽釘(CAP SCREW)		◎						
	8989 連桿；可調整(LINK; ADJUSTTBU)		◎		◎				
	8992 鏈;插承(LINK; FEMALE)		◎			◎			
	8993 軸承(BEARING SPIL)		◎			◎			
	8994 軸承(BEARING)		◎						
	8995 堵頭(PLUG)		◎			◎	◎		
	8996 鎖螺環(NUT；RETAINER)		◎			◎	◎		

起落架致動器零件特殊製程清冊
(ACTUATOR PART SPECIAL PROCESSES LIST)

類型(TYPE)	零件名稱(DESCRIPTION)	(1)珠擊	(2)鍍鎘	(3)鍍硬鉻	(4)液滲檢驗	(5)磁粒檢驗	(6)熱處理	(7)陽極處理	備註
10500-103/553 收放致動器 (Retraction Actuator)	10502 連桿(ROD-END)		◎			◎	◎		
	10508 帽蓋(GLAND NUT)				◎	◎		◎	
	10509 扣環項圈(COLLAR RETAINING)				◎			◎	
	10510 緩衝管(TUBE；DAMPER)		◎						
	10511 液壓缸本體(CYLINDER)	◎							
	10516 活塞(PISTON)		◎	◎					
	10519 環型扣環(RING；RETAINING)		◎						
	10520 支架(BRACKET)				◎			◎	
	10522 套筒(SLEEVE)		◎			◎			
	10524 軸承(BEARING)				◎	◎			
	10532 直接頭(UNION)				◎			◎	
	10537 減震環(RING DAMPER)				◎				
	10538 扣環(RETAINER)				◎		◎		
	10539 密封環(SEALING RING)				◎				
10600-1 輔助致動器 (Auxiliary Actuator)	10602 桿端接頭(ROD-END)		◎			◎	◎		
	10606 活塞(PISTON)		◎	◎		◎			
	10607 帽蓋(FLAND NUT)				◎			◎	
	10609 環型扣環(RING；RETAINING)		◎						
	10610 液壓缸本體(CYLINDER)	◎			◎			◎	
	10618 襯套(BUSHING)					◎			
	10619 套筒內襯(SLEEV；LINED)		◎			◎			

起落架致動器零件特殊製程清冊
(ACTUATOR PART SPECIAL PROCESSES LIST)

類型(TYPE)	零件名稱(DESCRIPTION)	(1)珠擊	(2)鍍鎘	(3)鍍硬鉻	(4)液滲檢驗	(5)磁粒檢驗	(6)熱處理	(7)陽極處理	備註
10700-105/551 穩定致動器 (Stabilizer Actuator)	10705 液壓缸本體(CYLINDER)	◎	◎						
	10707 桿端接頭(ROD-END)		◎						
	10710 帽蓋(GLAND NUT)				◎			◎	
	10711 套筒(SLEEV)					◎			
	10716 活塞(PISTON)		◎	◎	◎		◎		
	10718 墊圈(WASHER)				◎				
	10719 環型扣環(RING；RETAINING)		◎						

備註(NOTES)：

特殊製程代碼

(1) 珠擊(SHOT PEENING)：DCMP-136 (AMS-2430 AMS-2431 AMS-2431/1 AMS-2432/2)

(2) 鍍鎘(CADMIUM PLATE)：, DCMP-171, DCMP-172, DCMP-173, MIL-STD-870B, MIL-STD-871, AMS-2438 QQ-P-416

(3) 鍍硬鉻(CHROME PLATE)：QQ-C-320

(4) 液滲檢驗(PENTRANT INSPECT)：MIL-I 6866

(5) 磁粒檢驗(MAGNETIC PARTICLE INSPECT)：MIL-I-6866

(6) 熱處理(HEAT TREAT)：DCMP-130

(7) 陽極處理(ANODISE)：MIL-A-8625